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JULY

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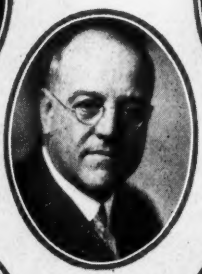

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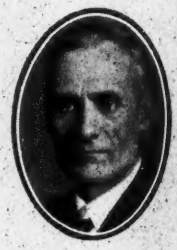

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Original Communications

UNILATERAL VS. BILATERAL BALANCED OCCLUSION*

By HUGH W. MACMILLAN, D.D.S., M.D., F.A.C.D., Cincinnati, Ohio

THE following paper is a compilation of the notes used in the lecture illustrated by the two reel motion picture film, "The Physiology of Mastication,"† which was produced in connection with the problem of analyzing, mathematically, the various stresses and strains to which the alveolar process is subjected.

Before it was possible to apply the laws of mechanics to the problem, it was obviously necessary to find out the path or direction of the various forces which are applied during the different phases of mastication. Since little work has been done in charting and analyzing the excursion of the mandible during actual chewing movements, an attempt was made to record this action graphically. Appliances were constructed on the mandibular teeth of individuals selected for study and a graph was obtained by the passage of the end of a bent wire spring indicator over a smoked glass plate. Analysis of this graph affords considerably more information than does our present knowledge of the muscles of mastication.

Coincidentally, types of wear were studied in extracted teeth. It was observed, as has been noted before, that in the case of the mandibular molars, the buccal cusps were usually worn, while the antagonizing upper molars were worn on the palatal surfaces. This occurred so commonly that it was assumed to be constant until, in an unusual type of malocclusion, the very opposite condition was noted; namely, the lingual cusps of the mandibular molars and buccal cusps of the antagonizing maxillary

*Read at the Greater New York December Meeting for Better Dentistry, New York City, Dec. 10, 1929.

†The two-reel motion picture film, "The Physiology of Mastication," can be obtained at a nominal rental from the Bureau of Dental Health Education of the American Dental Association, 58 E. Washington St., Chicago, Ill.

molars were abraded to such a degree that the cusps, as such, no longer existed. In certain other teeth observed, the degree of wear appeared equal on buccal and lingual cusps; and, of course, many variations from these extremes were found. Anatomists have said that given a single bone of an unknown animal, they could reconstruct the entire animal. It appears that given a worn tooth, it is considerably more difficult to reconstruct the excursion of mastication.

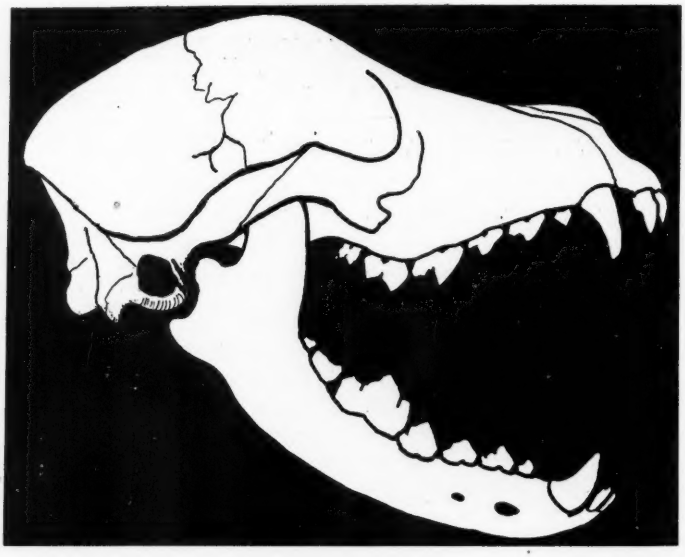

Fig. 1.—Jaws of a dog, which are capable of an almost instantaneous snapping motion to set the teeth. The temporal muscle, by its long muscle fibers and tendinous insertion, is especially adapted for extensive range of motion and combines speed with power to a remarkable degree. (Figures 1, 2, 5, 6 and 8 are from animated cartoons.)

At the time these studies were begun, I was in close collaboration with R. Plato Schwartz, now associate professor of surgery in charge of orthopedics in the medical department of the University of Rochester, N. Y. Dr. Schwartz was attempting to analyze gait by obtaining a graph through the use of an ingenious instrument attached to the pelvic girdle of the patient.[1] The idea of a graph as applied to mastication was first inspired by the intimate association with Dr. Schwartz in this work. With the thought that a more nearly perfect graph might be obtained by making moving pictures and then studying them frame by frame, a time consuming and aggravating period has been passed through in the attempt to record graphically by this method the various phases of the masticatory excursion. In part explanation of the term "aggravating," it should be realized that, until recently, the amateur did not have available for 16 mm. work the instruments of precision, the lighting equip-

1. Schwartz, R. P.: Method for Making Graphic Records of Normal and Pathologic Gaits, J.A.M.A., 90:86-88 (Jan. 14) 1928.

ment or the panchromatic films which are obtainable today. Amateur motion picture photography has become so standardized that the beginner no longer is compelled to go through the expensive "trial and error" period.

Instead of simplifying the study of the mandibular excursion during actual chewing operations, the motion picture seemed to complicate it, in that it presented still more evidence which had not been explained. The human mandibular movements, during the incising and masticating of actual foodstuffs, are so complex and so interrelated that it seemed

Fig 2.—Unilateral balance in the ox. The movement of the lower jaw from within outward carries the molars of the opposite side, known in the human being as the molars of the balancing side, still farther apart.

almost impossible to separate and explain each phase of the graph, as, for instance, in a heart tracing. In looking through various writings and books on comparative dental anatomy, most of which are shown in the film, reference to the work of Cope was found. He, in turn, referred to Ryder in describing the mandibular excursions of certain of the lower animals. With this as a basis, the work of recording the mandibular movements of these animals on the film was begun with the purpose of studying their predominating characteristics which, in turn, could be projected into the human movements and thereby explain, or at least furnish a clue for the explanation of, the corresponding movements in the human being.

The most casual observation of the dental mechanism of animals during function shows the complete lack of "bilateral balance" and "three point contact." James M. Prime has immortalized himself by the expression "enter bolus exit balanced occlusion." This statement is as much of a classic in dental literature as "Ubi pus, ibi evacuo" is in medical literature. The movie film, especially in the animated cartoons which are synchronized with the mandibular movements of the animals, shows that three point contact and bilateral balanced occlusion never occur in the lower animals during the process of incising and chewing tough resistant food. I assert that this is true also in man.

OCCLUSION

Dental science is founded for the most part on occlusion, which is the relation of the antagonizing teeth when the jaws are closed. Of far greater importance is the relation of the antagonizing teeth during the functional excursion of the mandible. "Centric occlusion" has been defined as the relation of the inclined planes when the jaws are closed in the position of rest. Thus, as far as function is concerned, centric occlusion is neutral occlusion. Centric occlusion occurs at the end of the masticatory excursion or when the work is finished. It is a hypothetic position which has nothing to do with the functional phase except as a descriptive term indicating the end or the beginning, as the case may be. The definition of centric occlusion is ambiguous, since

the jaws are not closed when in a state of rest. "The position of repose is neither complete closure nor opening of the jaws."[2]

"Eccentric occlusion" is defined as the relation of the inclined planes of the teeth when the jaws are closed in any of the excursive movements of the mandible. The excursions of eccentric occlusion are not limited to the normal functional movements of the individual. There are many excursive movements, such as those obtained by the prosthetist in taking extreme "lateral bites," which are not functional movements, since these positions are never assumed by the mandible in the preparation of the food for deglutition.

At first thought, the expression "functional occlusion" might be advanced to explain the relationship of the teeth during the various phases of food preparation, but the terms "functional" and "occlusion" are logically incompatible because "occlusion" is synonymous with "contact," and "function" takes place only in the interval before "contact," i. e., while the teeth are passing through the food. Masticating surfaces are worn, not by contact of antagonizing teeth (except in such a pathologic state as gritting the teeth), but by the abrasion produced by the resistant mineral matter in the

Fig. 3.—Teeth in the bicuspid region of the ox. In spite of being worn out of "harmonious" occlusion, these teeth continue to function in the preparation of the rougher foods.

2. Tomes, Charles: Manual of Dental Anatomy, New York: The MacMillan Company, 1923, p. 31.

food. By analogy, the upper and lower millstones are not worn by mutual contact but by the grain between.

FUNCTIONAL RELATIONSHIP

For want of a better term, "functional relationship" will refer, in this paper, to the relative positions assumed by the antagonizing teeth during the process of chewing actual foodstuffs. A number of questions are immediately prompted by this new addition to the nomenclature:

Fig. 4.—Lack of fusion of the two halves of the mandible of the ox, which indicates that it is impossible in the ox for the "muscles of both sides to exert their power . . . in the final crushing movement."

What would be the appearance of a graph made by an indicator attached to the mandibular first molar during functional excursion? Would the movement be of the orthal type of the pig, of the ental type of the steer, of the ectal type of the horse, of the proal type of the rodent, of the palinal type of the proboscidea, or of a possible combination of any or all these types? Would the appearance of the graph be different in malocclusion? Is the functional excursion of the mandible of the patient wearing artificial dentures the same that it was before the teeth were lost? Is the direction of the excursion reversed when the bolus is changed from the right to the left side? Does man or beast chew on both right and left sides at the same time? How is the mandible balanced when the teeth are being forced through hard, resistant food; or when the teeth on one side have been extracted; or when the patient has undergone the operation of unilateral resection?

The prevalent conception of three point contact and bilateral balance is summarized in a paper by George Wood Clapp as follows:

Three great facts characterize perfect natural dentures. They may be stated in advance, to be studied later. They are:

1. When the mandible is thrown to one side and brought into contact with the upper teeth, the lower teeth are in contact with the uppers at three widely separated points. On the side engaged in crushing the food the lower teeth from central to third molar are in contact with the opposing uppers. The lower third molar on the opposite side is in contact with the upper second molar. In artificial dentures this "three point contact" prevents dislodgment of either plate and permits the exertion of an amount of force otherwise impossible.

2. When the teeth are in lateral occlusion, the buccal cusps of the lowers are laterally in line with the buccal cusps of the uppers. The lingual cusps of the lowers are in line with the lingual cusps of the uppers. The sulci and fossae of the opposed occlusal surfaces form a space known as the rectangular groove. In this groove the food is compressed.

3. The food in the rectangular groove is finally crushed by the mandible sliding toward the median line. The buccal cusps of either set, on the side engaged in crushing, slide through the spaces between the teeth of the other set, or through buccal grooves. This relation of cusps to grooves, with the aid of the articulating molars on the oppo-

site side of the mouth prevents the dislodgment of dentures made on this principle.[3]

This final crushing movement is very short, probably not greater than half the width of the occlusal surface of the upper first bicuspid at the position of that tooth. Dr. J. Leon Williams believes it to be very much less than that, perhaps not more than one one-hundredth of an inch.[4]

It gives us our first glimpse of the mechanical plans underlying the articulation of good natural dentures in such a way that we may apply the same principles to the articulation of artificial dentures.

ture at three or more widely separated points. By thus supporting the mandible against tipping, it is possible for the temporal and masseter muscles *of both sides* to exert their power in the final biting or shearing movement, and in the final crushing movement. The power of the jaw is thus greatly increased over that which would result from the pull of only one set of these muscles.[5]

VALUE OF COMPARATIVE ANATOMY

In analyzing the functional relations of the human teeth, it is helpful to ob-

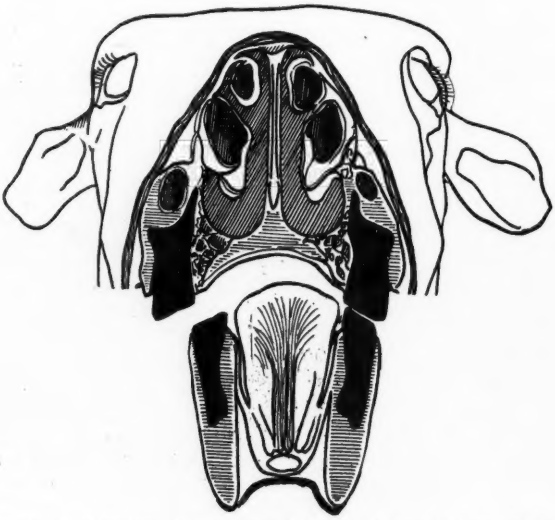

Fig. 5.—Diagram showing that, in the horse, bilateral balance is impossible during mastication. Unilateral balance is the state of equilibrium produced by the muscles of mastication of the working side which enables each half of the lower jaw to function independently of the other half as far as any support from the teeth of the opposite side is concerned.

We see, first, that in the position of direct occlusion and that of lateral occlusion the teeth interdigitate with almost the accuracy of gear teeth. We see also that in all positions where great force is to be exerted the mandible lies in contact with the upper den-

serve the more simple excursions in certain lower animals in which the action of the mandible is confined, for instance, to one plane. In the motion picture film, the pig, dog, steer, horse, rabbit and elephant are shown eating. Animated skulls and cartoons are synchronized with the

3. Clapp, G. W.: Mechanical Side of Anatomical Articulation, Dent. Digest, 15: 813 (Dec.) 1909.

4. Footnote 3, p. 816.

5. Footnote 3, p. 820.

functioning mandible and graphically depict the predominating characteristics of the various functional relations. For the benefit of those men who do not see the intimate relationship of these studies to the dental problems of the human being, the following quotation is included:

> The comparative method of study is the only scientific method, for one branch cannot be studied alone, but must be illuminated by comparison with kindred branches. Man is but an insignificant part of nature, and is connected in the closest ways with the animal kingdom. His body is identical with those of animals in its functions, and with all vertebrates, especially mammals, in its structure. Therefore his anatomy can become truly scientific through comparative anatomy and his physiology through comparative physiology. The structure and function of his organs are only to be fully understood by comparison with those of lower animals.[6]

6. Thompson, A. H., and Dewey, Martin: Comparative Dental Anatomy, Ed. 2, St. Louis: C. V. Mosby Company, 1919, p. 22.

TYPE I

In this type, the movement of the lower jaw is vertical (orthal mastication, as in suidae, tapiridae.) (Cope.)

"The lower incisors are straight and are implanted in an almost horizontal direction."[7]

"The two halves of the bone unite soon after birth."[8]

"Cuvier first pointed out that there was a relation between the presence of horns and the absence of canine teeth; the latter, serving as weapons of sexual combat solely and being probably in no other way of service to the animal, are not required by an animal provided with powerful antlers or horns."[9]

Fig. 6.—Skull of a rabbit. Evolution has here produced a much more efficient incising mechanism than one dependent on "three point contact."

7. Footnote 2, p. 454.

8. Sisson, Septimus: Anatomy of the Domestic Animals, Ed. 2, Philadelphia: W. B. Saunders Co., 1921, p. 173.

9. Footnote 2, p. 463.

The most striking characteristic of the mandible of the pig is its massive size. The combination of stresses in the anterior part of the mandible caused by strains received at right angles to the horizontal incisors and by twisting unilateral strains produced by the powerful leverage of the mandibular cuspids has produced thick, heavy labial plates, supported in turn by a heavily reinforced bony union of the two halves.

In a "Textbook of Clinical Periodontia,"[10] among the "conditions found to be

Fig. 7.—Cross-section in the molar region of the rabbit. Bilateral balance is impossible; unilateral balance, perfect.

essential to a complete normality of occlusion" are the following:

2. Normal vertical relationship of the teeth to the line of occlusion.

3. Normal inclination of the roots of the teeth.

It is difficult to reconcile the horizontally placed incisors of the pig with rule 2 of these empiric "essential conditions." Referring to rule 3, may it be asked what is the degree of the angle of inclination which has been accepted as normal?

The clinical application of this massive jaw development is directly related to the problem of development of the human mandible in orthodontic treatment. The use of the knife and fork has almost completely eliminated the need for incisors. The receding jaw of our modern civilization is evidence of the dependence on exercise in the second or environmental stage of development. In 1881, Roux wrote, "There must be distinguished in the life of all the parts two periods, an embryonic in the broad sense, during which the parts develop, differentiate and grow of themselves, and a period of completer development during which growth . . . can come about only under the influence of stimuli."[11] W. Ramsey Smith writes as follows: "The rule among Australian aborigines, as is not well known, is that the front teeth of the lower jaw bite flush against the upper, instead of underlapping them or underhanging them, as is the rule among white races."[12] T. Wingate Todd writes: "In Anglo-Saxon times almost the entire population possessed an edge to edge incisor bite."[13]

Watching the pig eat gives illuminating evidence of the different phases of the incising process. Among the chief muscles concerned in the act of incision are those attached to the nuchal crest, the entire head being forcibly jerked back when tearing off food. It is interesting to watch the fore feet functioning as

10. Stillman, P. R., and McCall, J. O.: Textbook of Clinical Periodontia, New York: The Macmillan Company, 1922, p. 68.

11. Russell, E. S.: Form and Function, New York: E. P. Dutton and Company, 1917, p. 320.

12. Smith, W. R.: In Southern Seas, London: John Murray, 1924, p. 74.

13. Todd, T. W.: Introduction to the Mammalian Dentition, St. Louis: C. V. Mosby Company, 1918, p. 149.

secondary incisal factors as they hold firmly the object being torn apart. Primitive man with his edge to edge bite, employing cooking little or not at all, having no use for etiquette or salad forks, employed many muscles besides those attached to his mandible for incising. Using an orthal type of movement, the incisor teeth were forced into the resistant food, holding it firmly while a mouthful was wrenched off with the hands. The triceps and the muscles attached to the occipital

etiology of the malposed unerupted third molar in the human.[14]

Cross-sections in the molar region of the mandible of the pig bear a close resemblance to cross-sections of similar regions of the human mandible.

An interesting study for someone should be the comparative anatomy of the internal pterygoid, since the mandible of the pig does not give the final lateral squeeze to the bolus as does the human being.

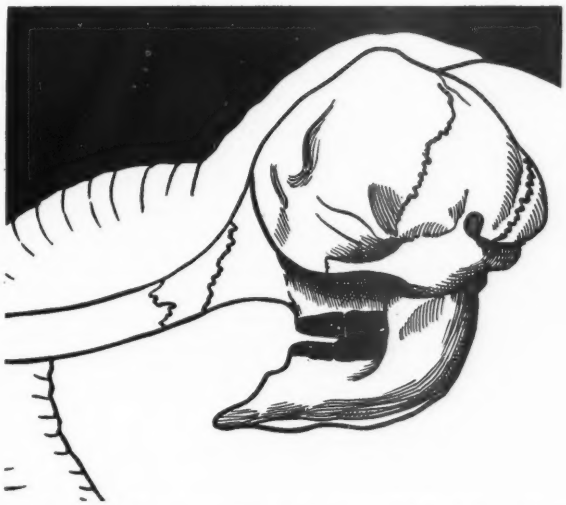

Fig. 8.—Skull of elephant. Chewing on one tooth above and one below, this animal affords the most striking example of unilateral balance.

bone were just as much concerned in the operation as the masseter and internal pterygoid. The leverage exerted on the adolescent jaw in the region of the ramus by the forces employed in the various phases of incising and masticating supplied the stimuli for the "completer development" of Roux. John Hunter's experiments showing the manner in which growth takes place in the mandible of the pig are significant as to the

TYPE II

In this type, the inferior molar shears forward on the superior molar. (creodonta; carnivora.) (Cope.)

"In the felidae, it [the glenoid cavity] is strictly transverse; their teeth adapted for slicing not grinding, would gain nothing by lateral motion, which is rendered

14. Keith, Arthur: Menders of the Maimed, New York: Oxford University Press, 1919, p. 230.

quite impossible by the manner in which the long transverse condyles are locked into the glenoid cavity by strong processes before and behind."[15]

"The two halves of the mandible do not fuse completely even in old age, so that there is a permanent symphysis mandibulae. The coronoid process is very extensive and is bent slightly outward and backward."[16]

In the comparative study of the muscles of mastication, the carnivorous type explains better than any other the function of the temporal muscle. "Bone is dominated by muscle function . . . where extensive muscular attachment is required we have a broadening of the bony surface."[17] The "great extent of the temporal fossa" and the extensive rugged coronoid process are evidence of these facts.

Depending entirely on animal life for their food, the carnivora have developed the most effective mechanisms for capture. In preparation for the seizure, the jaws are opened wider than that of any other type. For the almost instantaneous snapping motion to set the teeth, the temporal muscle, by its long muscle fibers and tendinous insertion especially adapted for extensive range of motion, combines speed with power (on account of its leverage) to a remarkable degree. After the prey is down, the powerful crunching and heavy masticating is taken over by the masseter and internal pterygoid muscles, which are constructed on the plan of power at the expense of speed. It is very likely in the human being that the temporal muscle functions only when the mouth is opened wide and that it travels along "sympathetically" with the masseter and internal pterygoid during trituration and comminution without developing any appreciable energy.

To glance for a moment at the temporal muscle of the ox, as an example of the pecora, one sees an organ of entirely different structure and function. The ox is not a beast of prey. Its teeth are not organs of offense or defense. Its food offers little resistance. It cannot open its mouth wide enough to accommodate a large ear of corn. The temporal muscle is confined in a relatively small temporal fossa, which is directed backward parallel to the body of the mandible. It functions in an entirely different manner from that of the carnivora. It affords a beautiful explanation as to how the posterior fibers of the human temporal muscle function in the retraction of the mandible.

A comparative study of the temporomaxillary articulation of the carnivora, with that of the temporomaxillary articulation found in skulls exhibiting the Angle Class III type of malocclusion helps one in analyzing the graph of the masticatory excursion of a patient of that type.

Another interesting observation in the carnivora is the distance between the occlusal surfaces of the maxillary and mandibular bicuspids when the jaws are closed. Apparently, the careful coordinating of opposing occlusal surfaces as advocated by the modern periodontist was not one of the "selective" methods employed in the development of that most efficient dental machine of the carnivora. The distance between the maxillary and mandibular bicuspids when the jaws are closed shows that opposing teeth function even though they cannot be brought into occlusal contact. The theory of "occlusion minus" apparently does not take this fact into consideration.

15. Footnote 2, p. 32.

16. Footnote 8, p. 194.

17. McKensie, W. C.: Action of Muscles: New York, Paul B. Hoeber, 1918, p. 4.

TYPE III

The movement of the lower jaw is from within outwards in this type (ental mastication, occurring mostly in artiodactyla). (Cope.)

"In the ungulates the condyle is rounded, the ascending ramus long, the pterygoid muscles are large, and the glenoid cavity is shallow."[18]

"In the ox the two halves of the mandible do not fuse completely even in advanced age."[19]

The chief characteristic of the pecora is the absence of the maxillary incisors. In their place "is a hard pad of cartilage covered with dense gum tissue, against which the lower incisors and incisor-like canines close in cutting off grass."[20] The absence of the maxillary incisors forcibly calls attention to the fact that three point contact, so long considered as the *sine qua non* in the human being, cannot occur in this type of animal nor does it occur in any other type, including man, during actual chewing or incising operations.

Examination of the mandibular deciduous incisor teeth in a 4-year-old steer shows them to be greatly worn; in fact, the crowns may be worn to the gums. Here is a beautiful example of excessive wear with no opposing teeth. At the beginning of this paper, it was mentioned that teeth were worn not by antagonizing surfaces coming in contact but by the abrasive action of the food.

Examination of the teeth in the bicuspid region shows such degrees of wear that the antagonizing teeth may lack 2 or 3 mm. of meeting. Yet the wear continues, showing the teeth are still in function and continue to prepare the rougher foods for finer mastication by the molars.

18. Footnote 2, p. 32.
19. Footnote 8, p. 139.
20. Footnote 6, p. 159.

"Inharmonious wear of the occlusal surfaces" is said to be one of the etiologic factors of "traumatic occlusion." I am still looking for signs of "incipient periclasia" caused by inharmonious wear unaccompanied by disuse.

What furnishes the most food for thought in a cross-section of the molar region of the ox is ". . . the relative narrowness of the mandible compared with the breadth of the palate. In consequence the upper and lower cheek teeth of one side only can enter into contact at one time: on the opposite side the upper cheek teeth project so far beyond those of the lower jaw that there can be no occlusion." In the ental type of mastication as found in the ox, this distance is still further increased with the movement from within outward. It is very apparent that the molars of the opposite side known in the human being as the molars of the balancing side cannot be of any assistance in equalization of stresses, in furnishing "balance" or "by thus supporting the mandible against tipping making it . . . possible for the temporal and masseter muscles of both sides to exert their power in the final biting or shearing movement, and in the final crushing movement."

The statement that the human temporal and masseter muscles of both sides exert their power in the final biting and crushing movement does not appear to be anatomically correct, nor could it occur mechanically. When chewing is performed on the right side, the excursive movement across the antagonizing surfaces is from right to left. When chewing is done on the left side, the movement is reversed. The muscles of mastication of one side are designed to move the mandible in a direction opposite to that produced by the muscles of the other side. One might as well claim that man could

walk forward and backward at the same time.

The fact that the symphysis remains uncalcified in the ox definitely indicates that only the muscles on the working side exert power to produce the masticatory excursion of the mandible. The muscles of the opposite side or of the side not working simply follow in "sympathetic" contraction. If force were transmitted from one side to the other, the region of the symphysis would become a lever in conformance to the law of bending stress which rules that "to resist bending moment stresses most effectively the material should be as far from the neutral axis as possible."[21] In other words, across the region of the symphysis would be a shaft of bone as solid as that found in the body of the mandible. Instead of this rigidity, only a loose fibrous union is present. In fact, it is possible to grasp each half of the mandible of a living animal and easily move the approximal surfaces of this loose joint up and down a distance of 10 mm.

In order to offer an explanation of the anatomic mechanisms involved in this conception of mastication and to provide a rational explanation for the "balancing" phenomena claimed to be produced by "three point contact" and "the opposite or balancing side," the term "unilateral balance" is advanced, being defined as the state of equilibrium produced by the muscles of mastication of the working side which enables each half of the lower jaw to function independently of the other half as far as any support from the teeth of the opposite side is concerned.

TYPE IV

The movement of the lower jaw is from without inward; i. e., ectal mastication, seen in many perissodactyla. (Cope.)

21. Footnote 13, p. 206.

"The two halves of which the mandible consists at birth unite during the second or third month, and it usually is described as a single bone."[22]

The mandible of the horse is of much stronger construction than that of the ox. The teeth of the horse are classified as secondary sexual characteristics and are used as weapons of offense. Owing to the resistance offered by the incisor teeth in the upper jaws, the stresses in the region of the symphysis are greatly increased, which accounts for the early union and ossification.

The incisors of the upper and lower jaws meet flush. In grazing, the grass is seized and held firmly by the incisors and torn loose by the action of the muscles which draw the head backward. Protrusion and retrusion are very slight, if present at all. The vertical fibers of the temporal muscle indicate a marked difference in the mandibular movements of the horse from those of the horizontal fibers of the temporal muscle of the ox.

Three point contact is entirely absent as the incisors cannot be brought together during the functional excursion of the molars.

"While masticating with one side of the jaws, the opposing dental series of the other side are not in contact."[23]

The horse furnishes another beautiful example of unilateral balance.

TYPE V

The movement of the lower jaw in this type is from before backward (proal, occurring in most rodentia). (Cope.)

"A peculiarity of the masticating apparatus . . . is the lack of postglenoid process, and the consequent freedom of

22. Koch: Laws of Bone Architecture, Am. J. Anat., 1917, p. 269.

23. Footnote 8, p. 70.

the lower jaw to slide backwards and forwards in mastication."[24]

"If we suppose the mouth to be open, the action of the masseter and internal pterygoid muscles draws the mandible forwards and upwards until the incisors have performed their office or the molars are in contact with each other or with the food. They then relax and the temporal muscle continues the upward pressure but draws the ramus backwards to the limit set by the adjacent parts, causing the act of mastication."[25]

In the rabbit, which is the animal shown in the motion picture to illustrate the proal type of mastication, the articulation is very loose, admitting wide lateral motion, which, however, is not used in the masticatory excursion. The flattened condyle moves backward and forward in the elongated space between the zygoma and the side of the skull, held in place loosely by ligaments but not limited anteriorly, posteriorly or superiorly by bone. The entire lack of glenoid fossa, eminentia articularis and tympanic plate in this most efficient masticating apparatus makes one wonder whether, after all, the glenoid cavity and the condyle path are of such supreme importance as the inventors of dental articulators assert. In a patient who had been operated on for bilateral resection of the condyles, Pryor has claimed a good functional result following insertion of full upper and lower dentures.[26]

At this point, it may be proper to emphasize the importance of a better understanding of the muscles which assure the equilibrium and balance that are necessary for wearing artificial dentures successfully. Many of the attempts to chart condyle paths and lateral bites and the arguments proving each method to be superior have been based, for the most part, upon speculation. It is high time to take up again the work on the structure of anatomic mechanisms, which has been temporarily laid aside since the last generation. H. O. Thomas used the expression "muscles appear to know."[27] Sir Arthur Keith writes, "We cannot overstate the importance of this complex silent mechanism, which regulates the movements of our limbs, because it is by understanding it and using it that the orthopedic surgeon hopes to find a rational system of treatment.

Why should such a mechanism be provided for the human body? Think for a minute what the conditions of life would be if every moment we stood erect, or every time we took a step, we had consciously, and by an effort of will, to set into motion, and regulate at every phase of that motion, the millions of muscle fibers which the act of standing or walking calls into action. If our limbs were so controlled life would be intolerable, and movement only possible for a genius."[28]

M. Cesare Cavina has so beautifully described the physiologic adaptability of the muscles of mastication, after fracture of the mandible that his description should be given prominence in American dental literature; "So, in spite of the faulty form of the mandibular bone, if its continuity is assured, if the soft parts and the articulations are intact, and if the prosthesis is well constructed a good functioning of the jaw is possible by means of the three following physiological resources: the adaptation of the temporomaxillary articulations to the vicious

24. Cope, E. D.: J. Morphol., 3:251 (Sept.) 1889.

25. Footnote 24, p. 263.

26. Footnote 24, p. 265.

27. Footnote 17, p. vi.

28. Footnote 14, p. 114.

orientation of the jaw, the instinctive search of the lower teeth to join their antagonists, the faculty of being able voluntarily to modify dental articulation."[29]

In the act of gnawing, the mandible of the rodent is brought into its most forward position. When the tips of the incisor teeth touch, the molars are far apart. Examples of incising furnished by various members of the rodent family, such as cutting down hardwood trees and gnawing through the hard shell of nuts, indicate that evolution has produced a much more efficient mechanism than one dependent on "three point contact." In the act of incising, the edges of the anterior teeth meet flush, the force being exerted at right angles to the long axis of the teeth while they are passing through the hard wood or shell of the nut. At the end of the incisive excursion, at the instant the opposing teeth come in contact, the power produced by the muscles is "tripped" reflexly either by the contact itself or by "muscle sense." Clinically, it is important to realize that the hundreds of pounds pressure which may be exerted during incising or in mastication on teeth with normal occlusal surfaces is present only when the teeth are being retarded by the resistant substance—it is not exerted after the teeth come in contact.

The amount of force exerted by the muscles is dependent on the resistance offered, by muscle sense and by voluntary control. While it is possible for the muscles of mastication to exert 300 or 400 pounds pressure, this amount of force is used only when required. The jaws do not work as a hydraulic press whose piston has as much force behind it in crushing an empty tin can as in crushing an iron casting. In the mastication of a meal of consomme, creamed sweetbreads, mashed potatoes, cottage cheese salad and ice cream, it is doubtful that a total of 400 pounds of energy is expended. This is the usual diet of the patient being treated for "traumatic occlusion."

In molar mastication, the jaw of the rabbit is carried posteriorly, the incisor teeth being widely separated, which makes three point contact impossible. A cross-section of the molar region (Fig. 7) shows the impossibility of any help from the "balancing side." Nor is there any need of help. Each side is self-sufficient.

The rabbit furnishes still another beautiful example of unilateral balance.

TYPE VI

The movement of the lower jaw in this type is from behind forward (palinal, occurring in proboscidea). (Ryder.)

"Two striking features characterize the dentition of the elephant: the enormous length of the incisor tusks and the peculiar displacement from behind forwards of the molar teeth, by which it results that not more than one whole molar, or portions of two, are in place at any one time."[30]

The ridges of the enamel plates are arranged transversely to the movement of the mandible; which is also the general rule for the other types described.

The elephant is a constant feeder. It is said that he eats almost continuously during the twenty-four hours. Since the food is of low caloric value, vast quantities of it are necessary for the development and maintenance of his energy requirements. For the preparation of a "ton of food a day," not more than one

29. Cavina, M. C.: Dent. Surgeon, 25:171 (March 31), 1928.

30. Footnote 2, p. 476.

molar or parts of two at the most are in opposition on each side. As the teeth proceed in their "eruption" from behind forward, the anterior tooth is worn out of occlusion so that chewing is perfomed on each side by only two opposing teeth. As there are no mandibular incisors, cuspids or bicuspids, three point contact is impossible. The absence of cusps on the molars of the other side makes bilateral balance impossible.

The elephant affords the most striking example of unilateral balance.

The clinical application of unilateral balance will be taken up in subsequent papers.

CONCLUSIONS

1. "Bilateral balanced occlusion" and "three point contact" occur neither in the lower animals nor in man during the process of forcing the teeth through tough, resistant food.

2. The statement, "the temporal and masseter muscles of both sides exert their power in the final biting and crushing movement" is incorrect.

3. Unilateral balance is the state of equilibrium produced by the muscles of mastication of the working side which enables each half of the lower jaw to function independently of the other half as far as any support from the teeth of the opposite side is concerned.

ROOT ABSORPTION OF PERMANENT TEETH. II. A STUDY OF BONE AND TOOTH CHANGES INCIDENT TO EXPERIMENTAL TOOTH MOVEMENT*

By JOHN ALBERT MARSHALL, D.D.S., Ph.D., San Francisco, Calif.

THE purpose of this paper is to present and to discuss the experimental data so far obtained which deal with anatomic changes in bone and teeth produced when tension is developed by orthodontic appliances placed on the teeth of monkeys.

That these laboratory findings are similar in some respects to those which have been observed clinically has already been pointed out in detail in a paper read before the American Society of Orthodontists in July, 1929.[1] At that time, not only were the bone changes discussed, but the degree and nature of apical absorption were also described.

To understand the pathologic processes involved, it is necessary to review briefly the sequence of events which occur when deciduous teeth are lost during the normal processes of growth. Studies on

*Read before the Section on Orthodontia at the Midwinter Clinic of the Chicago Dental Society, Jan. 15, 1930.

*Aided by grants from the American Society of Orthodontists, the Pacific Coast Society of Orthodontists and the Board of Research of the University of California; conducted at the George Williams Hooper Foundation for Medical Research and the College of Dentistry, University of California.

1. Marshall, J. A.: Studies on Apical Absorption of Permanent Teeth. I, Internat. J. Orthodon., January, 1930.

Fig. 1.—Apex of left maxillary permanent central incisor. There is unusual irregularity of the periphery of the cementum. (× 25.)

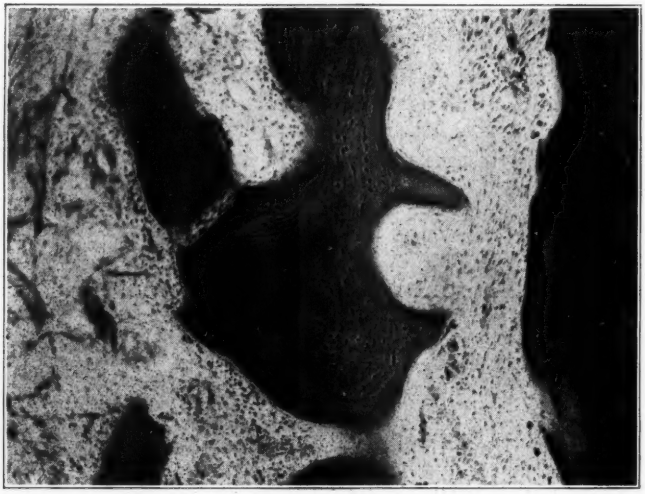

Fig. 2.—Beginning of cementum and dentin absorption on distal aspect of permanent incisor.

Fig. 3.—Apex of permanent left maxillary central incisor. There is a thick mat of fibrous tissue between the eroded cementum and the bone. (Van Gieson; × 90.)

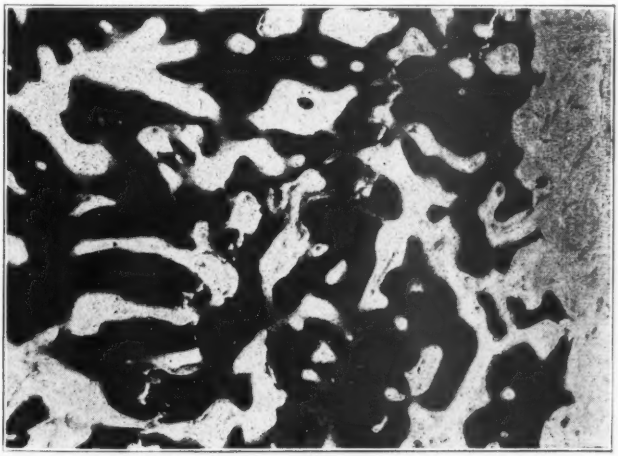

Fig. 4.—Irregular line of fracture between the maxillary permanent central incisors extending transversely across the field.

deciduous teeth reported elsewhere[2] have indicated that, contrary to the generally accepted point of view, the peridental membrane is not the only tissue concerned in bringing about the root resorption in the first set of teeth. This process is materially aided when the tooth contains a healthy pulp, for it is found that this organ functions with the peridental membrane in bringing about and in maintaining, toward the end, an increased rate of radicular resorption. Deciduous teeth containing healthy pulps respond quickly to those forces which are concerned with the resorption of their roots. On the other hand, teeth which have become carious and which have developed infection of the pulp give evidence of delay in their exfoliation. The results of such a slowing up are too well recognized to merit detailed description. It should be mentioned that the normal growth of the mandible and maxilla is interfered with unless the permanent teeth are permitted by favorable conditions to erupt. With pulpless deciduous teeth, the reaction resembles more closely that which occurs sometimes at the apices of infected roots of permanent teeth. In this case, loss of tooth structure is brought about by the cementoclasts of the peridental membrane, and the resulting slow erosion of both cementum and dentin is essentially a pathologic process, to which the term "radicular absorption" is applied.[3] In contradistinction to this, the normal exfoliation of deciduous teeth is essentially a series of growth phenomena and as such is an expression of the normal function of bone-building cells as well as of bone-destroying cells. Consequently, one may say that the shedding of deciduous teeth is physiologic in character and anatomic in its development rather than pathologic.[4]. The two processes, resorption and absorption, although both responsible for apical erosion, are dissimilar in etiology, histogenesis and histopathology; for not only are there different causes for the apical resorption of deciduous teeth and of absorption of permanent teeth, but also both the origin and development of the process may likewise be diverse. Furthermore, it is emphasized that, in the case of deciduous teeth, the active process of resorption is accelerated toward the last. In this way, the erupting tooth, now with a fully formed crown and partly formed root, moves into line in the arch.

In the case of infected pulps in the permanent teeth, in which the infection has involved the peridental membrane and bone, another process occurs. Dentin and cementum, either or both, may be absorbed, and the mechanism by which the root is eroded is similar to that seen in "rarefying osteitis." When referring to this process in the tooth, the term "rarefying cementitis" might be applied.

But the process arising from mechanical trauma is noninfective. It develops and proceeds relatively slowly. This is not to be considered as an osteohalisteresis, for this term includes the pathologic condition in which the bone becomes softened either through a deprivation of mineral salts, or else from their absorption by infectious or metabolic disease. It is rather an osteolysis and odontolysis in which loss of both bone and tooth substance has been brought about by in-

2. Marshall, J. A.: Diseases of the Teeth. Their Diagnosis and Treatment, Philadelphia: Lea and Febiger.

3. Marshall, J. A.: Comparison of Resorption of Roots of Deciduous Teeth with Absorption of Roots of Permanent Teeth Occurring as a Result of Infection, Pacific Dent. Gaz., 36:597 (Oct.) 1928.

4. Marshall, J. A.: Disc. of Ketcham, A. H.: Internat. J. Orthodon., 13:121 (Feb.) 1927.

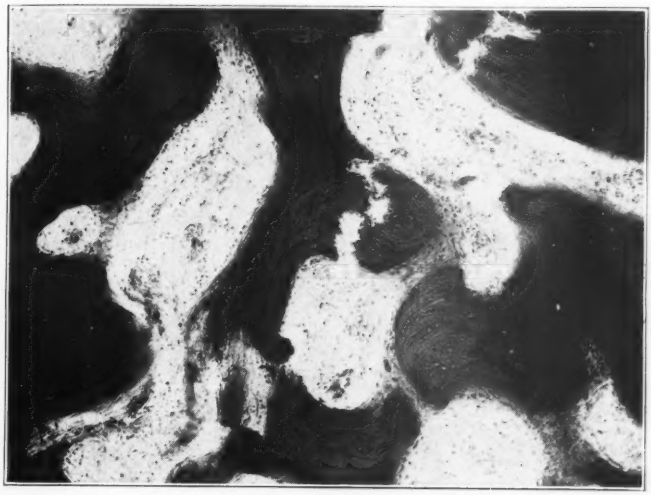

Fig. 5.—Fractured alveolar bone between maxillary permanent central incisors. (Hematoxylin-eosin; × 90.)

Fig. 6.—Longitudinal section of right central incisor and a portion of the mesial aspect of the left central incisor.

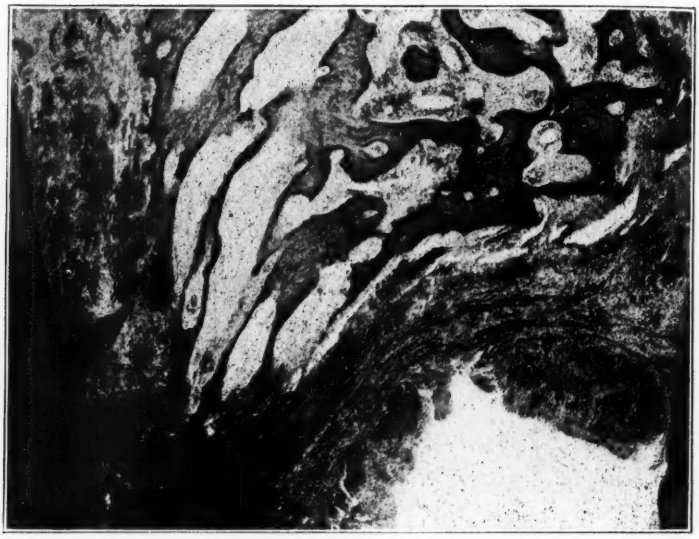

Fig. 7.—The bone and soft tissues between the central incisors. In the movement of the right central incisor, the supporting structures have been dragged along to such an extent that the general direction of their fibers nearly parallels the long axis of the tooth.

Fig. 8.—Manner in which connective tissue fibers and bone have been pulled downward by the tension of the appliance. (Van Gieson.)

juries associated perhaps with certain types of orthodontic treatment. The rate at which it progresses is relatively constant, as indicated by the roentgenographic evidence. There is another point of dissimilarity between osteolysis and rarefying osteitis. In the former process, the evidence at present available is to the effect that an increase in the degree of mechanical trauma, or, if you prefer, an increase in stresses produced by tooth movement, does not tend to increase perceptibly the loss of bone or tooth substance. With an infection, the case is different.

If conditions arise subsequently whereby the tissue resistance in the infected area is lowered, or additional injury to the tissue occurs, the erosion of the residual root does not proceed any more quickly. Instead, the osseous structures are reattacked and an apical abscess of either an acute or a chronic form develops.

With the exfoliation of normal deciduous teeth, this process does not occur. An extra wiggle, so to speak, even so severe a twitch as to cause hemorrhage, may serve further to loosen the loose tooth. Frequently, the child realizes this point and is able to pull out the tooth himself, but it is probable that, by this time, the crown is the only part of the tooth remaining, and the extra back and forth movement accomplishes merely a further loosening of a few residual fibers of the peridental membrane. No such result follows in the case of the permanent tooth; first, for the reason that the attachment to the alveolar bone is more dense and firm; secondly, because the permanent teeth, even in cases of radicular absorption, rarely become loose enough to be extracted by the fingers; and, finally, because it is somewhat unusual to find that radicular absorption of permanent teeth has progressed to such a degree that only the crown portion remains.

With these comparisons in mind, it is possible to discuss with somewhat greater clearness the pathology of apical absorption occurring as a result of mechanical stress. Instances of this nature have been reported in the literature almost from time immemorial. It remained for Albert E. Ketcham, of Denver,[5] to correlate these observations in his own practice and to stimulate others to do likewise.

Dr. Ketcham's studies[6] have given rise to several interesting queries, not the least of which deals with the response which may be produced in bone as a result of abnormal tension or stress. Perhaps of equal importance are some of the following questions:

1. In what proportion of orthodontic cases may apical absorption occur?

2. What relation has this occurrence to the duration and type of previous orthodontic treatment, and what is the relation to those cases in which orthodontic "interference" has never been attempted?

3. Which factors are the more important in favoring the development of this condition—the local ones as represented by the general phrase "unusual mechanical stress," or the general ones grouped for convenience under the term "systemic causes?" If an unusual mechanical stress is responsible, in what way does it operate and how may it be avoided? If the body as a whole is at fault, in what direction does this fault lie and how may it be corrected?

In the report already referred to,[1] a few experimental details have been presented. These include the description of the various diets both normal and defi-

5. Ketcham, A. E.: Internat. J. Orthodon., 13:97 (Feb.) 1927.

6. Ketcham, A. E.: Pacific Dent. Gaz., 37: 137 (March) 1929.

Fig. 9.—Slight degree of inflammation reaction evident in the tissues adjacent to the left central incisor. (Hematoxylin-eosin.)

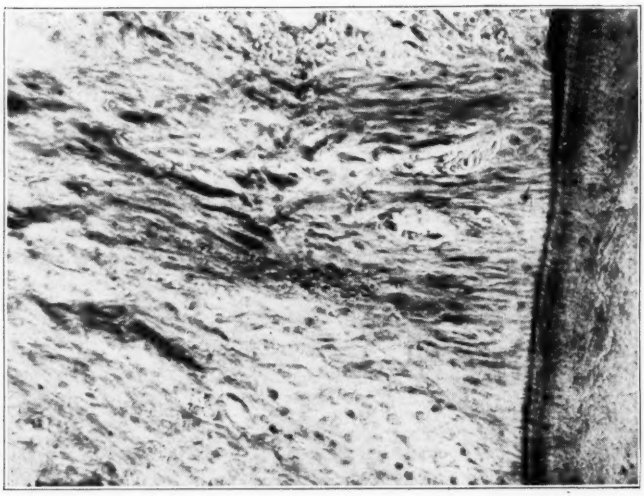

Fig. 10.—Section showing direction of the fibers attached at the alveolar crest to the left central incisor.

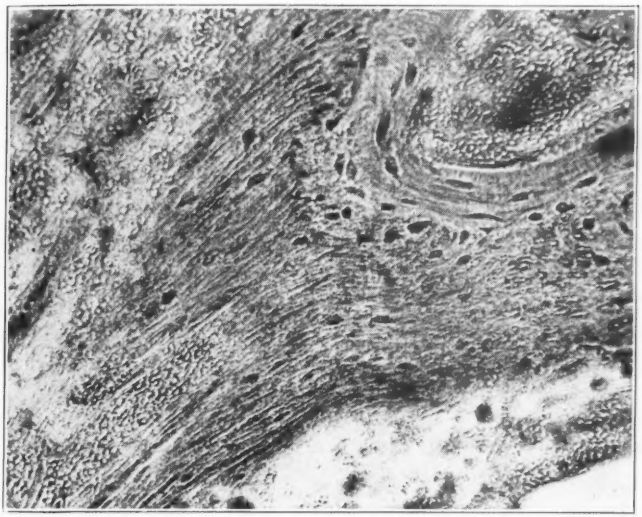

Fig. 11.—Photomicrographic appearance of the bone adjacent to the right central incisor, indicating that the lamellae were being pulled downward in the direction of the movement of the teeth.

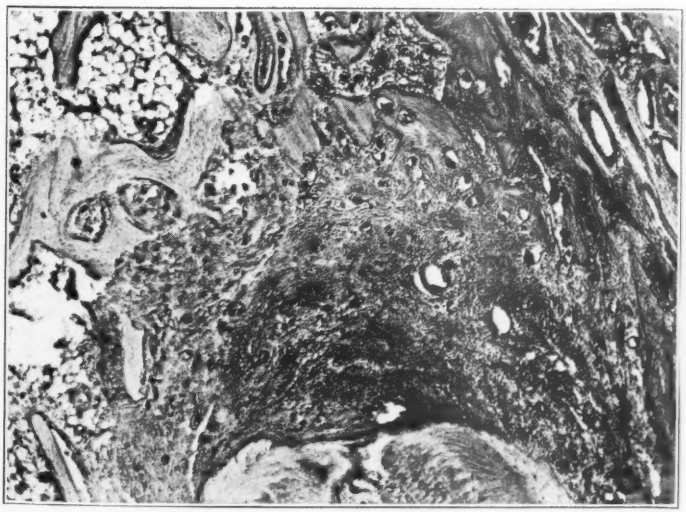

Fig. 12.—Apex of right central incisor. The width of the fibrous tissue indicates the original position of the tooth apex before movement occurred.

cient, as well as the types of orthodontic appliances which were used.

It is sufficient to say at this time, therefore, that four movements of the maxillary permanent central incisors have been studied: (1) distal movement of the crowns; (2) the rotation of the teeth by ligature; (3) the depression and elongation, and (4) the labial movement on one tooth and the lingual movement of the approximating one.

The roentgenograms of these various experiments have been studied closely, but so far the apical changes which have been observed by Ketcham and others have not been found to the same extent in experimental animals. There are several reasons for this. For one thing, the longest time that an appliance has been in place is only a little over one year. The report on this monkey is not included at this time. A second one has had an appliance in place only eight months. This particular animal was on a regular diet and was healthy at the beginning of the experiment. The appliances consisted essentially of two bands placed on the maxillary permanent central incisors. The movement was produced in such a way that the crowns were separated distally from each other.

The degree of stress maintained during the experiment has been so great that a distinct pulling or stretching of the peridental membrane fibers is demonstrable even under low magnification. In some places, the fibers appear to be almost ruptured by the distal movement of the crowns of both teeth. But the continuity of the membrane, even under these unusual conditions, remains unbroken. As the apex of the tooth is approached, it is apparent, from the sections, that considerable changes have occurred in both the cementum and the peridental membrane. For example, in Figure 1, there is shown an irregularity of contour on both the outer border of the cementum and the pulpal wall of the dentin.

May I digress for a moment to mention briefly a few differences between normal and pathologic tooth substance?

In the case of normal growth, both dentin and cementum are laid down evenly without noticeable variations in thickness and without any perceptible break in the irregularity of the contour. But the teeth which have been moved experimentally present certain irregularities, and in place of the unbroken contour, there are small notches or cupped out places on the periphery of the root. This is indicative of either of two conditions: (1) an interference in the normal process of cementum formation or (2) an attack on the fully formed root by odontoclasts and cementoclasts. These agents, it is presumed, have been stimulated to activity by the mechanical stress produced on the crowns of the teeth.

It is true that the well-defined, eroded areas such as have been noted in clinical cases of long standing apical absorption are not demonstrable in this particular animal, although they do occur in other experiments. When it is recalled that the appliances were in place only eight months and that the tension was almost disruptive in its nature, we may assume that the tissue changes, although severe as far as peridental membrane and bone are concerned, had not developed to a like degree in the cementum. Several eroded places on cementum areas are more highly magnified in Figures 2 and 3. The distal movement of the crowns produces a reciprocal mesial movement of the respective roots, so that they were being forced toward each other while their respective crowns were being separated. Therefore, one would expect to find somewhat more apical absorption on

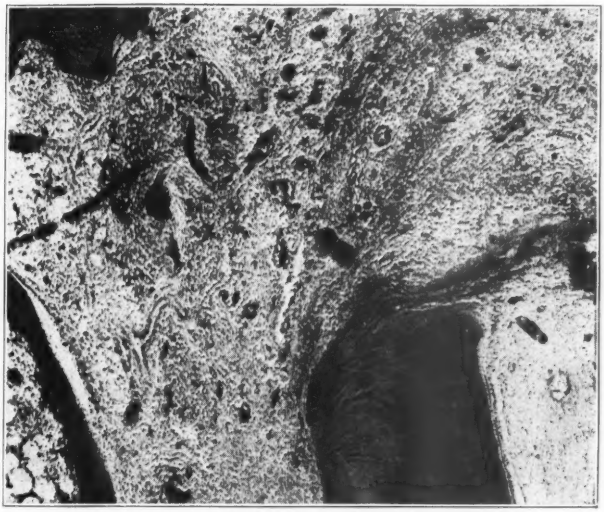

Fig. 13.—Apex of the right central incisor. The tooth has been pulled away from the bone and there has been little time for calcification to keep up with the rate at which the tooth was moved in the jaw. Small centers of ossification can be recognized in the mass of tissue packed over the apex.

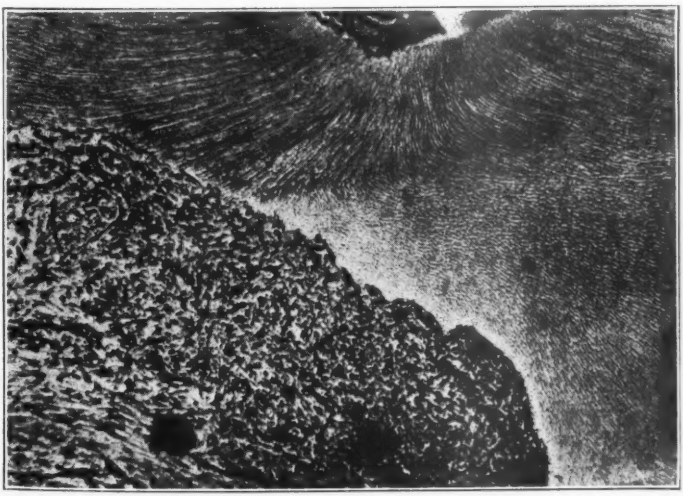

Fig. 14.—Normal resorptive process occurring on the roots of deciduous teeth.

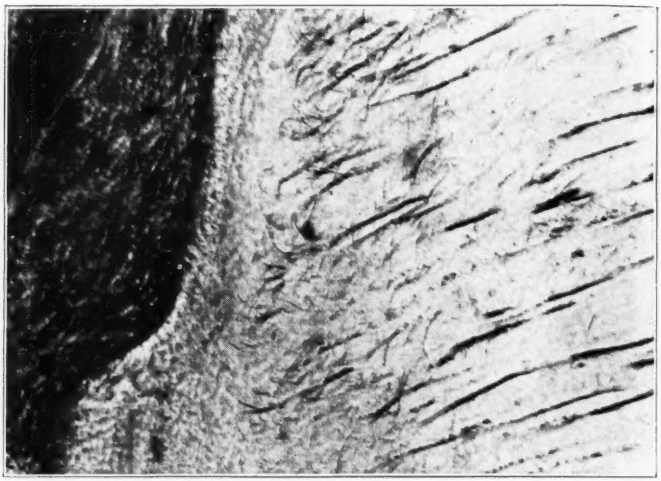

Fig. 15.—Area of absorption showing effect on the fibers of the dentin matrix.

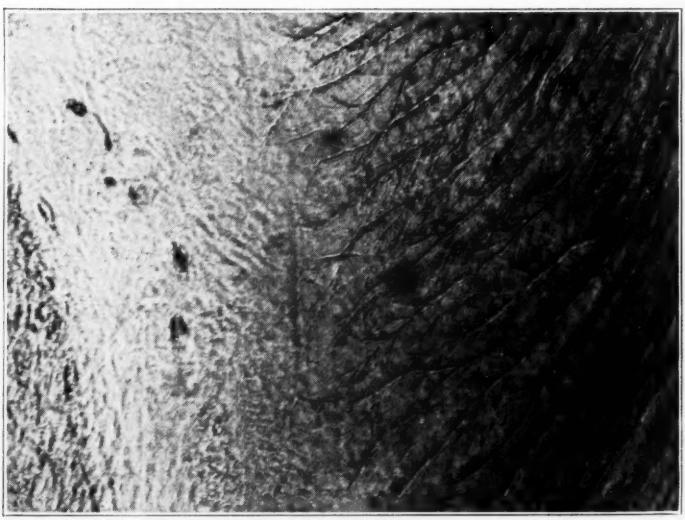

Fig. 16.—Partly attenuated fibers of the dentin matrix. There is an area of absorption on the distal aspect of the distal root of the right maxillary first permanent molar. (Schmorl.)

the mesial aspects of each root than on the distal. But the evidence on this point is still inconclusive, partly owing to the fact that the teeth were permitted to drift back, on two occasions, nearly to their original position. There are, it is true, more places which are superficially eroded on the mesial portions of each root, but the distal aspect also presents a few scattered areas. Of outstanding significance is the great amount of fibroblastic activity occurring around the roots. It is probable that the force used in moving the two teeth brought such stresses to bear on the bone in the apical region that osteoclastic action and resultant tearing down of osseous tissue have been followed by an extraordinary fibroblastic response. For example, in Figure 3, the thickness of the peridental membrane and the coarseness of the fibers contained therein suggest that an active change in the position of the alveolar wall was in progress. The porosity of the bone, which is unusual in this area, indicates that osseous changes were rapidly occurring.

Examine next the alveolar process at its crest. The tissue here is apparently normal. About 5 mm. apically from the crest, an irregular white line crosses the osseous tissue, as demonstrated in Figure 4. It will be noted that this line, which has a transverse direction, extends from the border of the alveolar bone of one central incisor across to the other one. With somewhat higher magnification this white line throughout its extent proves to be a distinct fracture. This is shown in Figure 5. It is suggested that this was the point of greatest stress, the "movable fulcrum," so to speak, of the lever which forced apart the crowns of the teeth. It is apparent that, in the effort to produce apical absorption in this experiment, too great tension was applied. When measured in the physics laboratory by Jolly balances, it required 1¾ pounds pressure to return the bands to the position they occupied at the beginning of the experiment. This introduces an interesting sidelight on the problem: How may the tension which is imparted to spring wire be measured before, during and after an experiment? Would such a measurement be of use during the progress of orthodontic treatment in the office?

A summarized experimental protocol of another of the animals is of interest in evaluating the results and in interpreting them. For instance, the specimens made from animal 2 show some differences in amount of apical peridental membrane, and in density of bone. This animal was on a special diet throughout the course of the experiment. Just after he arrived in the colony, he developed a large subperiosteal abscess over the occiput. This arose from the effects of several wounds received during a fight with one of his cage mates. Bands were placed on the teeth of this animal, Nov. 16, 1928, and were so adjusted as to produce mesiolingual rotation of the left maxillary first permanent molar. The other two teeth which were moved were the maxillary permanent central incisors. The right central incisor was elongated slightly and the left depressed into the alveolus. Periodic examinations of the appliances from Nov. 16, 1928 to Jan. 4, 1929 show that they were in place satisfactorily.

From time to time, the molar band was tightened and pictures, roentgenograms and motion picture films were taken of the animal. He died, Jan. 9, 1929. Necropsy revealed a great number of intestinal parasites and the cause of death was found to be amebic dysentery.

There are several points of interest in connection with the maxillary permanent central incisors. An examination of the

tissues between these two teeth, especially in the region shown in Figure 6, indicates in a striking manner the effects produced by elongating the right central incisor. Even at a magnification of only 12 diameters, the dragging effect on the bone is quite evident. This is demonstrated in greater detail in Figures 7 and 8. At point *X* on the illustration is the left central incisor. The tooth was not permitted to extrude from its alveolus, but the tension was so applied as to force the root deeper into the maxilla. The general direction of the bone lamellae in this area is parallel with the alveolar crest and perpendicular to the long axis of the tooth. In this case, the teeth were not tipped from their normal vertical position. But the bone as it approaches the right central incisor has an entirely different appearance. It is pulled out or dragged along, or, perhaps more correctly, is building new bone hastily so as to follow this unusual movement of the tooth root to which it is attached. The result is that the alveolar crest, in this position, instead of lying perpendicular to the long axis of the tooth, now nearly parallels it. But in no place has a fracture developed. Why? Perhaps because the animal was on a diet inimical to normal bone development and that instead of hard well-calcified tissue, the osseous structures were more elastic, which permitted them to be pulled along with the tooth. The bone response seems to have been sufficient to maintain the integrity of the tissues without producing serious injury to them. In fact, in the case of the left central incisor, there is hardly an appreciable amount of inflammatory reaction. This is indicated by Figure 9. The details of the fibers are more clearly shown in Figure 10, with van Gieson stain and the section magnified 300 diameters.

This pulled out appearance of the bone at the alveolar crest near the right central incisor is illustrated in Figure 11. The lamellae take a general downward inclination following the direction of stress.

At the root apex of the right central incisor, there was evidently a wild scramble on the part of the osteoblasts to keep up their end. The direction of movement of the tooth may be visualized by studying Figure 12. The osseous tissue normally present in this area has been left far behind. Bone is being formed rapidly, but the root is moving faster, and the space between is filled with fibrous connective tissue rather lightly and loosely built (Fig. 13).

In the case of normal resorption on roots of deciduous teeth, the picture is quite different. The fibrils of the dentin matrix extend to the junction of the soft tissue with the dentin. (Fig. 14.) Under these conditions, there is no effort made on the part of the pulp of the deciduous tooth to deposit secondary dentin, and thus obliterate the fibrils. But in apical absorption (Fig 15), the invading peridental membrane produces a pathologic reaction sufficient to stimulate the dentin fibrils of the odontoblasts to action. Secondary dentin is formed in the dentin tubules, and gradually both tubules and fibrils lose their identity as such and become a portion of the ever-widening granular layer of Tomes. Thus, it is seen that this partial obliteration of the fibrils may occur in either the crown or the root portion of the tooth. In the crown, it is found as a result of a long-continued irritation, such as may develop, for example, in an area of cervical erosion, occlusal abrasion or attrition, or under a long standing carious process. In the root, it is found now, I believe for the first time, to be associated with areas of radicular absorption, occurring either as a result

of infection or of unusual mechanical stress brought about by experimental movement of teeth. (Fig. 16.)

It is important to remember that unless the sections are cut in a plane parallel to the longitudinal axis of the tooth, misinterpretation of the material is very apt to occur. Furthermore, there are areas of absorption which do not seem to be characterized by these attenuated dentin fibrils. It is possible that the speed at which the process develops accounts for the fact that, in some cases of radicular absorption, the disintegration of the fibrils, which results in their attenuated appearance, does not occur. The process has been too fast.

The latter condition is analogous to that found many times in caries of dentin and pulp infection. The pulp undergoes degenerative changes, and thus the protective function which it exercises under the influence of certain stimuli is interfered with. It is undoubtedly the case that the rate at which experimental radicular absorption progresses is dependent on local factors as well as on systemic conditions arising from faulty metabolism; and, furthermore, that the teeth and bone respond in widely varying degrees to the stresses and movements initiated and maintained by orthodontic appliances.

STATUS OF PERIODONTIA IN DENTAL PRACTICE*

By SIDNEY J. RAUH, D.D.S., Cincinnati, Ohio

THE number of specialists has so greatly increased within recent years that the layman is hard put to it to differentiate between them, and even the members of the same profession have not always more than a bowing acquaintance with their brethren-once-removed. We have the following specialists: the periodontist, pedodontist, pathodontist, exodontist, orthodontist, prosthodontist, radiodontist, research worker, dental hygienist and dental economist.

Many patients today are selecting their dental specialists without consulting a dentist in general practice, and physicians also frequently refer cases directly to the specialists. Exodontists, periodontists and radiodontists are acting as consultants. This practice has the decided objection that, in their points of view, they must, of necessity, be motivated by a highly specialized mind and influenced by an experience based upon a particular kind of practice. It has never been customary for the surgeon to be the diagnostician except in his own field. The internist or general practitioner in medicine as a rule makes the diagnosis after using all the tests, signs and symptoms, and then the case is referred, or at least there is a consultation before a decision is reached. On the other hand, it is common practice for a radiodontist to diagnose from a roentgenogram and then to report his

*The papers of Drs. Rauh, Sherwood, Yeretsky and Keilty make up a symposium on "Clinical Periodontia."

*Read before the Section on Periodontia at the Seventy-First Annual Session of the American Dental Association, Washington, D. C., Oct. 9, 1929.

findings to a physician, in most cases without even a casual examination of the mouth and its tissues.

The dentist must recognize the case that should be referred to the specialist, the case which the specialist is better qualified to diagnose and treat, because it is unusual or difficult, or because, for any reason, the dentist does not choose to handle it. The public should be taught that each case must be started with a general practitioner, who will select, in his patient's interest, that specialist most competent to do the particular kind of work required. But the chosen specialist must keep in contact with the general practitioner. This applies to medicine as well as to dentistry. It is common practice for a patient to go from one specialist to the other with never a complete diagnosis. Often, when a patient consults a physician, he is referred to a radiodontist in a case of rheumatism or arthritis, and is advised to have teeth extracted without seeking the advice of a dentist. Let there be coordination; with a director (the man in general dentistry) familiar with the case from its inception, and kept informed as to its handling by those to whom he has referred it. A dentist in a small community where there are no specialists treats all cases and develops himself accordingly. Certainly, the general practitioner in the large centers has better facilities, and more, for so doing.

Beyond a doubt, there is a vital necessity in periodontic practice for both general practitioner and specialist. Since the advent of the latter, it is interesting to note the types of cases that have come into his practice. First, there are the general man's failures. They occur largely through the neglect of the patient to carry out the most important part of all remedial and preventive procedure, namely, home treatment. Then there are the incurables—as unconvinced as they are incurable. Next come the malcontents, the patients dissatisfied with the personality of their dentist or with his fees. The specialist is best known in exclusive circles. His following is drawn largely from the people who can afford to pay. The highly specialized operations performed by experts are often of small value and give but short relief. For example, implantation, which is advocated by a nationally known specialist, is regarded by him as worth while for the patient if it gives a service of only six months to two years. People of limited means cannot be treated in this way, and if these operations are to be performed, they lie distinctly in the province of the specialist. Apropos of special provinces: that practitioner is guilty of a serious neglect of duty who refuses to refer to the orthodontist his cases requiring interference.

All professions in this materialistic age cater to those who pay the most, with the result, quite naturally, that men and women unusually proficient in any definite technic specialize, and reap the benefits of exclusiveness. On the other hand, there is a group that fail to succeed in routine practice because they cannot qualify. Whereupon they specialize, hoping to be able to do a small part well. This works out successfully sometimes, and sometimes the reverse.

In professional life, the first obligation is to the patient, dental economics notwithstanding.

This great government is experiencing the result of machine-made environment, conducing to materialism. Success is being measured according to a dollar standard. Doubtless, the professions are affected by the psychology of the materialist.

The one great economy of the American public is toothbrushes. Several years ago, statistics compiled from toothbrush importation and local manufacture showed that not more than 40,000,000 brushes could have been used that year. With an average of two per year to an individual, we could boast only 20,000,000 brushers, or less than 20 per cent of the population of the United States. Of this number, naturally, a large percentage would come from those whose incomes are under $5,000 per year, so that the really affluent would be in the neighborhood of 4,000,000 families, counting five to the family. Of this number, not more than 20 per cent at the outside, or 800,000 are, financially, first-class patients. Estimating that there are 75,000 dentists in our country, they would average ten patients per year, drawn from the so-called rich. The average practitioner is the backbone of the profession, and it is largely through him that dental standards can be maintained or elevated with the great bulk of the people. Therefore, in all branches of dentistry, and particularly in periodontic practice, our great hope is with and through him.

Periodontic treatment is constantly becoming more necessary owing to general environmental conditions. The principle causes of periodontoclasia are: (1) improper diet, including consistency of foods; (2) improper mastication; (3) traumatic occlusion; (4) bad mouth hygiene; (5) systemic disease (e. g., syphilis, diabetes); (6) malocclusion; (7) anatomic defects, and (8) poor dentistry.

The necessity and opportunity for diagnosing these signs and symptoms must begin with the expectant mother and must be continued through childhood and adolescence. The opportunity for observing and preventing will always be with the general practitioner, in the main.

With notable exceptions, the control of caries and mouth hygiene, in general, through the first fifteen years of life, results in satisfactory adult oral conditions, the ultimate goal of dentistry.

Prevention, the neglected phase of medicine and dentistry, is the great hope of the future, and here is a fertile field for the rank and file of our chosen profession. Each one must first become imbued with this principle, and then pass it on to his clientele. Perhaps for the reason that it is comparatively simple, it is too often overlooked. Every client must be instructed and encouraged in tooth brushing and proper mouth toilet. Then, let him pass it on to the children, or reverse the process. Few young children are capable of manipulating the brush. It is important for mothers to have this fact pointed out to them, so that they may be prepared to assume the additional duty of performing this act regularly for their children under 10, and when the father will assist, a highly satisfactory result is the reward. Mouth hygiene propaganda has in recent years, made considerable impression on school and health authorities. They have come to see the importance of this field; but too often they are doomed to disappointment, finding many dentists unwilling to give adequate treatment to those who come under their care as a result of this education. Most of the force of this movement has sprung from the general practitioner, for his view has been broadened through contact with varied conditions in child and adult. A broad view is essential to the working out of any problem, and dentistry is no exception to the rule. Periodontia is its most important branch.

No specialist should be tolerated who has not had at least five, better ten, years of general experience following his preliminary education. Since dentistry in itself, being practiced within four walls, is none too broadening as a vantage from which to view life in general, a subdividing is prone to make it excessively narrowing.

The general practitioner must make himself more of an expert in periodontia. It is no more difficult than any other branch. It is just as interesting, and, on the whole, more closely related to medical practice. The periodontic specialist must interest himself in general practice, and in every way encourage the dentist to elevate his standards and teach him that prophylaxis is as important as fillings, bridges and dentures. As in every vocation, cooperation and elevated educational standards are goals that are to be constantly striven for.

Group professional combinations are the intermediates between specialists and general practitioners. The reason that this excellent plan has not been more widely promoted is perhaps that it is so difficult to gather together individuals who not only have a peculiar aptitude each for one branch, but who are, besides, temperamentally capable of adapting themselves to their colleagues. It requires one strong personality to coordinate their efforts—the hub of the wheel as it were. Each member must be proficient in his line. Try to imagine an excellent, orderly technician in dentistry in close association with a research worker, or an oral surgeon and a periodontist, drawing dividing lines as to their fields.

In addition, capital, such as finances any business, must first be secured. Business acumen is the essential for at least one of the group, probably the leader. He will demand a substantial return on the investment, again creating an institute to be patronized by those "able to pay." It might be feasible to employ in a dental group supervised young practitioners each attempting circumscribed duties; one applying himself to the placing of amalgam and cement fillings, another working at inlays, another on impressions for dentures, etc. This would entail the constant changing of "assistants"; for the really proficient would soon demand broader fields for their talents.

In the free dental clinics, in schools and institutions, this plan has been quite successful in a limited way, and many newly graduated dentists have had virtually an internship with good supervision. Such a system results in better professional training, and the first years of professional life are thus financed.

Let it be understood that no reflection on any specialist or specialty is intended. This is simply an effort to define and stress their limitations. Periodontic practice is no different in principle, as compared to general practice, from the other branches, with the tremendous exception that the preventive side fits in more closely. Therefore, every dentist should be a periodontist.

In status, periodontia should be first and foremost at all times in general practice.

DISCUSSION

John P. Becker, Cincinnati, Ohio: Dr. Rauh's major contention is that the general practitioner, rather than the specialist, should be the man who first meets the patient for the initial diagnosis of any dental ailment or problem. He holds that the specialist is not so well qualified to diagnose in the general field as is the general practitioner, on the ground that his field of experience is too limited. He likewise holds that the physician should not send a patient directly to the specialist but should first direct him to the general man, who, in turn, will decide whether a specialist is needed, and, if so, to whom

the patient should be referred. Later on, Dr. Rauh holds that no man should be tolerated as a specialist who has not had five, or preferably ten, years in general practice. Is he not here inconsistent, or do the five or ten years' general experience in no way qualify the specialist for giving as basic a diagnosis as the general practitioner? My belief is that the specialist is not only as well qualified to give a general diagnosis as the general practitioner, but, in many cases, is much better qualified because of the more exacting requirements he has had to meet in order to qualify as a successful specialist. Dr. Rauh says: "The general dentist is or should be better qualified to know whether a specialist is needed, etc." The crux of the matter lies in that phrase "or should be." If we could be sure that every general practitioner actually was "better qualified," his contention would be predicated on a sound basis, but until that millennium comes, I for one will still believe that the specialist is generally quite as able to diagnose and serve the patient's best interests as the general practitioner and, as said above, often even better qualified to do so. Dr. Rauh states that the specialist gets most of his patients from these sources: 1. The general practitioner's failures, the incurables and the malcontents, and finally from the rich people who seek "exclusiveness" in their treatment. My feeling is that the general practitioner's "failures" are due not so much to lack of cooperation on the part of the patient in his home treatment, as to the inability of the general practitioner properly to diagnose the basic conditions at the start. As for the specialist, catering to the "exclusives" because they "pay better," I have not found it so in my practice. If the rich people seek out the specialist in greater numbers than any other class, my conviction is that it is because, as a rule, they have a better understanding of the advantages of having certain types of work handled by men who have become especially proficient in a given field, and not because they can receive the treatment elsewhere. Rich people are not usually such easy marks as we take them to be. The truth is that the bulk of a specialist's practice is almost certain to be made up of a large "middle class" group, just as is the case in the general practitioner's work. There is also a hint in the paper to the effect that a number of specialists become specialists when they find they cannot succeed very well in general routine practice. I do not believe this to be the case. If a man hasn't it in him to succeed in general work, he will not get very far as a specialist. With Dr. Rauh's contention that the specialist should have an initial five or ten years' experience before focusing on his specialty, I most heartily agree, and for that very reason I feel that the specialist is better qualified than most general practitioners to give an intelligent and basic service to the patients who come or are referred to him, whether they come on their own volition or are sent by a physician or by a general practitioner.

Arthur H. Merritt, New York City: The family dentist must be regarded as the backbone of dentistry. It is on him that the public logically depends. If periodontia is that department of dental practice which concerns itself with the study, prevention and treatment of periodontal diseases, I think you will agree with me that it should be the concern of every dentist, not simply of a handful of specialists. Specialization should not be undertaken by any one who has not had a wide experience in general practice. If the specialist has had that, he certainly ought to be, other things being equal, as well qualified as a diagnostician as is the general practitioner, and, in his specialty, he might be better qualified. Periodontia is fundamentally a part of the practice of dentistry, and so cannot be separated from it with entire satisfaction to anyone. I would like to see every family dentist practicing periodontia, and when he does the work in this field as well as he ought to do it, and can do it, there will be fewer specialists in periodontia.

F. R. Talley, Petersburg, Va.: As a general practitioner giving a great deal of my time to periodontal diseases, I would say that the serious problem is to get the entire cooperation of the patient. There is a psychologic factor entering into the intercourse between the man in general practice who is practicing periodontia and the patient that is made easier when the patient approaches the specialist whom he knows is doing nothing but that particular work. When he goes to the specialist, and knows that he is paying the latter a fee in excess of what the general practitioner is charging, he is more liberal in his cooperation with the specialist than with the man in general practice doing periodontal work. I believe that, as Dr. Merritt has said, the man in general practice is the backbone

of the dental profession, and I believe that the man who is specializing in periodontia is an outgrowth of failure of the man in general practice to so familiarize himself with the early symptoms of a periodontal condition that he can, at least, call his patients' attention to this condition and then if, through choice, he does not care to do this work himself, can send his patient to a man who will give the proper treatment as a solemn, moral obligation, and a duty to the patient. This, I believe, is one of the greatest faults with the general practitioners, men who are not willing to do the work themselves and are not willing to call their patient's attention to it and send them to a man that will do it, for fear that the patient will have a lowered respect for them as dentists, or some such reason, and, consequently, they are not living up to their moral obligations to their patients, and not only making possible, but also imperative a field for specialists in this work. It behooves us as general practitioners to pay more attention to this condition, more than many of us have done in the early stages of periodontal trouble and if we do not care to handle the case ourselves, to send the patient to a man who will do it.

Dr. Rauh (closing): I approached this subject from the standpoint of the general practitioner, which signifies that I am practicing periodontia, including prophylaxis, denture work, operative dentistry and what not. It is not suggested, as Dr. Becker possibly thought, that the specialist has not contributed to general practice. The specialist has probably contributed more in every branch of dentistry to general practice than the general practitioner has to the specialties because that is one of the main functions of a specialist. He is an essential in a progressive profession, and leads the way, and the general practitioner must take the things which he teaches, and discovers, and apply them in general work. If he does not do that, he is not doing his duty. I want to be put on record as not being opposed to specialism, because, as a whole, specialists are more proficient in their lines of work. When it comes to diagnosis, which is most important, there are men in all specialties that do diagnose exceedingly well. Particularly in periodontia does this apply, for the periodontist is frequently a better diagnostician than the general practitioner. He has roentgenograms made in practically all of his cases, and perhaps that type of specialist is qualified to be a consultant. Even exodontists, at times, are excellent diagnosticians. We make a plea for the general practitioner to diagnose accurately and thoroughly. Dr. Merritt suggests that he become such an excellent periodontist that he will drive the specialist out of practice; a thing "devoutly to be wished." As regards cooperation of the patient in general practice, that type of patient who goes to the specialist has been educated, as suggested in my paper. He is leaving his general practitioner for some reason. He must have a reason or he would not leave. When he goes to the specialist, he will give, on the whole, cooperation far better than he would with the general practitioner. On the other hand, those patients who do not leave are the ones for whom you do your best work, and because of the cooperation which can be brought about, excellent results are obtained. Tooth brushing should be stressed by the general practitioner with the same enthusiasm as the making of an inlay or the construction of a denture. The dentist assumes in his own mind that it is difficult to educate, for which reason it is. If he will assume that it is in the general line of practice, he will find that it is similar to any other branch. It is just as simple a matter to convince a patient as to the importance of general care of his mouth as it is regarding the necessity for a new set of artificial teeth.

HOW SHOULD THE GENERAL PRACTITIONER EQUIP HIMSELF FOR THE PRACTICE OF PERIODONTIA?*

By CLYDE C. SHERWOOD, D.D.S., Toledo, Ohio

BEFORE entering into the discussion as to how the general practitioner should equip himself, or herself, for the treatment of periodontoclasia, I find it necessary to consider several points that have a vital bearing on the subject.

My first impression, when assigned this subject, was that it should have been given to one engaged in teaching dentistry; at least, to one more familiar with the art of teaching or having some connection with university work. But, having accepted the assignment, I began to diagnose my own feelings in the case. What I found was quite insufficient, and what ideas I did possess I wished to have verified. A questionnaire suggested itself as a means of getting a widespread expression on this most important subject. The response given me by dentists from all over the United States and Canada was indeed most beneficial, and I wish to express my gratitude to everyone who so promptly answered my questionnaire.

Question 1: Should the dentist in general practice treat periodontal disease? The reason for asking this question was that, to my mind, the future of periodontia depends on the answer. Shall the dentist in general practice treat periodontal disease or shall it be left to the specialists? With but few exceptions, the answers favored the general practitioner, many believing that a practical knowledge of periodontia would raise the standard of his general dentistry, and that all cases in their incipiency should certainly be taken care of by him.

Arthur H. Merritt answers this question thus: "Yes, because it is the most fundamental thing in dental practice, because such diseases are easily prevented and are not difficult to treat if taken in their incipiency, and because a handful of specialists cannot hope to meet the requirements of the public."

"The dentist in general practice," says Paul R. Stillman, "should by all means treat periodontal disease. If not the dentist in general practice, how then can the relatively few periodontists and competent dentists hope to cope with it as a profession?"

The few who are opposed took the attitude that the dentist in general practice lacked interest and sufficient understanding, and so could not give intelligent treatment, believing that he should by all means practice prevention and prophylaxis. Frederick A. Bricker believes that the general practitioner cannot develop the sense of touch necessary for delicate scaling and does not have the opportunity for observing the changes continually taking place during treatment as does the person who limits his practice.

*Read before the Section on Periodontia at the Seventy-First Annual Session of the American Dental Association, Washington, D. C., Oct. 9, 1929.

These are certainly sane and sound answers to this question.

Question 2: What, briefly, is your method of procedure in treating periodontoclasia?

It was not my purpose to find any special or definite answer to this question, but merely to find, if possible, just how far apart, or how close together, the profession really were on the question of procedure in treatment. To give the answer from every dentist would be quite impossible.

Benjamin Tishler believes in the use of full mouth roentgenograms and good models of teeth when necessary; removal of hopelessly diseased teeth and replacement with good substitutes; occlusal grinding; removal of root deposits, and careful instruction to the patient regarding gingival massage with the toothbrush.

Julian Smith lists: "1. General prophylaxis. 2. Correcting occlusion. 3. Toothbrush instruction. 4. Rest for observation. 5. Root surgery. 6. Final prophylaxis and examination as to results."

James Gregory O'Neill: "Four major steps: 1. Occlusal equilibration. 2. Superficial scaling. 3. Surgery of pocket. 4. Instructions in proper care of the mouth."

Olin Kirkland: "A conservative surgical operation under block anesthesia."

Austin F. James: "1. Diagnosis. 2. Instruction as to diet. 3. Home care. 4. Instrumentation. 5. Balancing occlusion. 6. Thorough and continual prophylactic treatments."

John Oppie McCall: "1. Equilibration of occlusion; relieving excessive occlusal stress. 2. Giving stimulation to the blood supply of the marginal gingivae, preferably with the toothbrush. 3. Apoxesis. 4. Use of epithelial solvent (sodium sulphid)."

E. J. Weaver: "Our treatment is surgical, radical or otherwise, as the case seems to indicate. In my opinion, 80 per cent of the periodontoclasia presented is simply a local manifestation of a physical condition. The general set-up must be looked into and the general diagnostician must work hand-in-hand with the dental specialist in treating these cases. Of course, the specialist must take into consideration traumatic conditions and all other contributing causes which may be classed as contributory factors. A limited number of cases, of course, owe their inception purely to traumatic conditions."

Question 3: What, in your opinion, is the one most important procedure in treatment which might be applied to the general practitioner?

M. H. Garvin: "Regular prophylaxis and examination every three months, and instruction in home care."

Frederick A. Bricker: "Preparing himself (the dentist) to teach the patient intelligent care of the oral cavity."

The answers to this question were unanimous as to the use of prophylaxis and teaching effective mouth hygiene.

Question 4 (The subject for real discussion): How should the general practitioner equip himself for the practice of periodontia?

Paul R. Stillman: "Study and work."

Austin F. James: "By making use of the things he need know if he is a graduate of any dental college."

C. W. Hoffer: "By visiting the offices and watching the procedure of the periodontist."

A. W. Bryan: "The training that he receives in school, if a relatively recent graduate, should be sufficient. The older practitioner could brush up by studying published articles and books on the subject."

Leslie Waddill: "By spending a few weeks with a reliable periodontist. Learn a sane technic and get proper instruments. Read all articles on the subject and use common sense."

Russell W. Bunting: "By spending as much time and effort in maintaining the health of the supporting tissues as he does in the making of inlays and fillings for the teeth."

D. P. Mowry: "Study the histology of the dental tissues, the physics of occlusion, the phenomena of inflammation, the relationship of morphology to function. The technic and the type of instruments are easily found when the foregoing knowledge is obtained."

Grace Rogers Spalding: "1. Training the eyes to recognize the slightest deviation from normal gum tissue in color, form and tone. 2. Study. 3. Consultation at frequent intervals with a reliable and successful periodontist who could advise him concerning equipment and demonstrate a simple technic. 4. A good course of instruction. This is invaluable when practical, but not essential. 5. Attendance at the meetings of the American Academy of Periodontology and the Section on Periodontia of the American Dental Association."

George Wood Clapp: "The general practitioner might be better prepared for the practice of preventive dentistry by a course of training that would first of all give him a better conception of what the practice of dentistry ought to mean than is general at present."

Isador Hirshfeld: "By taking one or more postgraduate courses as an introduction; by studying clinically the normal periodontium and observing closely the pathologic; by treating as many cases as he can procure, graduating to the more difficult ones. He should cultivate an active interest in reading special literature on the subject and observe clinics. Lastly, he should avoid all 'special aids' such as medicaments, vaccines and radical operations, until he has grounded himself thoroughly in the fundamentals. If he can do this, the probabilities are that he will not have to resort to the former except out of mere curiosity."

H. J. Leonard: "At present, there are not available very good places for schooling in this subject. Several schools have well-developed courses for undergraduates, but these are not available to practitioners." Dr. Leonard advises getting material from articles and then working it out oneself. He does not approve of high priced courses in private offices. "The best periodontists," he states, "have 'dug it out' for themselves by practice, trial and error, with such help as they could get from articles and clinics."

Sidney Sorrin: "He must study and learn how to master the knowledge that is essential to cure any case of periodontal disease, which includes (1) study of the tissue involved in treatment; (2) removal of all etiologic factors, especially traumatic occlusion; (3) the scientific method of instrumentation; (4) proper instruction in gingival stimulation by use of a toothbrush. Other agencies employed may be of assistance in the procurement of health, but they will not prove successful unless the dentist understands the principles upon which the treatment of periodontal disease is based. This education may be procured by postgraduate study and the practical experience obtained in dental clinics."

The increasing interest in periodontia leads one to believe that the dentist, physician and public are beginning to realize fully the significance of periodontia as related to health. Dentistry

has taken its rightful place along with medicine as a real division of health service. People are being restored to health by the proper administration of dental service. The dentist of today must be recognized as a diagnostician, for he certainly is justly entitled to this recognition. Dentistry has passed just its mechanical stage. Never in the history of dentistry has art and technic been so highly developed. Now, let us develop the medical side of our profession, stressing the relation of dentistry to our bodily health. While the dentist is in need of knowledge related to conditions in medical practice, just so is the physician in need of knowledge relating to clinical dentistry and its relationship to human welfare.

Periodontia is the meeting ground of the dentist and the physician. It is here that the dentist must begin to get his real professional contact with the physician. If for no other reason than just this one, the dentist in general practice should know periodontia: at least, he should be thoroughly familiar with its true relationship to health.

It has long been my opinion that the dentist in general practice should not only treat incipient cases of periodontoclasia, but should also be equipped in every way to practice prevention and treat the more advanced cases. The supporting structures of the teeth are the real foundation of all dentistry: why should they be so sadly neglected or be eliminated from the general practice of dentistry?

Time will not permit the discussion of procedure in the treatment of periodontoclasia. To me, the most important and the one most sadly neglected is the *teaching of effective mouth hygiene.*

Some of our most successful periodontists have been preaching it for years. In the past, the patient has been merely told to brush his teeth, with no thought of stimulating the gums. If we are to attain any success in the treatment of periodontal disease, we must teach effective mouth hygiene. The patient should be told the cause of periodontal disease. We should explain just what part the blood supply plays in the control of infection and should emphasize the importance of cooperation of the patient as related to success or failure.

Just how the general practitioner is to best equip himself for the practice of periodontia has been so thoroughly outlined by my friends from all parts of this country and Canada that I feel it unnecessary to make any further suggestions.

I commend for your study the outlines that have been given previously in this paper, also suggesting a compilation of all the current literature, reprints and everything available that you can get possession of. Place them under one cover, with proper index and classification. You will then have at your finger tips the most recent material published on the subject.

I urge the general practitioner to become interested in periodontia, believing that he will get a new viewpoint in dentistry. A new interest in the profession will be thus created and the patient will receive the added value in service to his health.

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DISCUSSION

C. B. Vaughan, Boston, Mass.: These four questions are vital to every man interested in the treatment of periodontal disease. There is no question that every dentist should be able to recognize and treat incipient periodontia cases, and in so doing diminish the number of advanced cases as time goes on. But how many dentists in general practice today find that, in spite of their best efforts,

many cases seem to retrograde. Such cases are for the specialist, and when we realize that, even under his trained care, the results are not always all that could be hoped for, how can we expect the busy general practitioner, who is occupied with countless operations of every sort and only able to give an occasional hour or so to a well-developed case, to get results. The man who has had no special training such as the treatment of periodontal disease requires is doing a great injustice to his patient and to himself when he takes the responsibility of this particular type of case. He is equally unfortunate when he neglects the more simple case; so that periodontal disease should be treated by both the general practitioner and the specialist, each taking those particular cases which his knowledge and skill fit him for treating. Again, the question of time has much to do with the answer to this question. Naturally, the longer a man is in practice, the greater the demands that will be made on his time; and, for that reason, it is impossible to carry on a large general practice and a large practice of periodontia at the same time and do justice to either one. Question 2, as to methods of treating periodontoclasia, does not admit of much discussion as nearly all periodontists agree that there are three important steps, namely, surgical curetment of all root surfaces, balancing occlusion and stimulation of the gums by massage. As for Question 3 (What in your opinion is the one most important procedure in treatment which might be applied to the general practitioner?), it seems to me there is no one most important procedure. Each of the three mentioned procedures are equally important. Each is so dovetailed into the other that no definite or lasting result can be expected if any one of the three are left out. Surgical curetment of the roots alone, leaving an unbalanced excessive stress on the teeth, will not be permanently successful. Neither will balancing the occlusion, leaving rough root surfaces, with consequent irritation to the surrounding tissues, be successful. When health has been restored, by both surgical curetment of all root surfaces and balancing of the occlusion, health will not be maintained without painstaking follow-up work by both the dentist and his patient in the way of gingival massage. So it would seem that there must be three definite procedures to provide one important cure. Question 4 (How should the general dentist equip himself for the practice of periodontia?), had it been asked ten or fifteen years ago, would have been most difficult to answer. Had it been asked at that time, I doubt that the answer would have been forthcoming. It seems to me that the ease with which it can now be answered is a great tribute to the periodontists who have made it possible to answer it. Fifteen years ago, the teaching of the treatment for periodontal disease in the dental schools was practically nonexistent. Today, in one of our university dental schools, there is one department, with a full-time man and a corps of instructors, in which a complete course of study and clinical instruction is given. This department is operating during the entire school session. Hundreds of cases, including every stage of periodontal disease, are treated by students. Anyone graduating from a school giving such a course will be equipped to begin work in this specialty. The same school last year gave a postgraduate course of ten days of intensive instruction under university supervision. It was largely attended. I am sure there are other schools giving similar courses. There is no better way than this for the general practitioner to equip himself. The entire subject is covered in such a course in a short period. The sacrifice of time is small and the educational value great. In such a course as this, the student derives the benefit of instruction from a group of men. This is better than taking instruction from one individual. It has been customary in the past to procure instruction in private offices. This is very satisfactory, provided the right office is selected. I believe such an introduction to periodontia desirable; but at best is only a beginning, and private instruction is not calculated to train men as specialists, but simply to give the general practitioner a foundation, and a stimulation to render better service in this field. The proper source of all dental teaching is the accredited university school.

RECOGNITION OF INCIPIENT PERIODONTOCLASIA BY THE GENERAL PRACTITIONER AND HIS OBLIGATIONS THEREFROM*

By WILHELMINA YERETSKY, D.D.S., Grand Rapids, Mich.

NEARLY all cases of periodontoclasia or "pyorrhea," as the layman usually terms it, could be avoided if the signs pointing in that direction were recognized by the general practitioner and treatment and preventive measures instituted in time. The smallest deviation from the normal in a mouth is important enough to call for a remedy. Not infrequently, patients come to us and say, "I told my dentist that my gums bled when I brushed them, but he looked in my mouth and said they were all right and many people's gums did bleed when they brushed them." Bleeding of the gums always indicates something wrong and is the most frequent signal preceding periodontoclasia. Normal gingival tissue is a light even pink, firm and continuous about the teeth.

The inner surface of the gingiva at the neck of the tooth is normally lined with a layer of epithelium continuous with the oral mucosa and extending to the base of the crevice where the soft tissues are attached to the cementum. This epithelial layer, when intact, offers considerable resistance to the invasion of bacteria, but when it is incomplete, as it frequently is, organisms which have established themselves in the gingival crevice may enter the submucosa and peridental areas. If the prevailing type of bacteria in these areas is purulent or proteolytic, they may readily erode the epithelial lining of the gingival crevice and directly attack the adjacent submucous tissues. When infective processes become established in the gingival areas, they enter the tissues along the lymphatic channels of the peridental membrane, which run lengthwise of the root of the tooth. Thus, the oral infective organisms may pass the first line of defense, the oral mucosa, and penetrate the deeper peridental tissues, their progress being determined by the virulence of their attack and the degree of tissue reaction by which they are opposed.[1]

In order to discover an incipient periodontoclasia, or an incipient gingivitis, which is the preceding stage, it is necessary to examine minutely the area surrounding each tooth. The color of the tissue must be noted carefully and then a probe passed carefully about the gingival margin to see whether there is any break in the attachment to the cementum. The finger of the operator may be used in palpating the tissue to see whether there is any unusual swelling or any oozing of blood or pus from the tissue under pressure. The dentist must know first what normal tissue feels like. A casual

*Read before the Section on Periodontia at the Seventy-First Annual Session of the American Dental Association, Washington, D. C., Oct. 9, 1929.

1. Bunting, R. W.: Oral Pathology, Philadelphia. Lea & Febiger, 1929.

examination with a mouth mirror will not reveal these symptoms. So much emphasis has been placed on the use of the roentgen ray in diagnosing pathologic conditions of the mouth that the dentist is liable to place too much dependence on them. A roentgenogram is of little use in diagnosing incipient gingival lesions, and so the dentist must rely on his eye and his sense of touch.

Practically all the local causes of periodontoclasia are under the control of the dentist, and those causes which are not directly under his control, he must be familiar with, and so a tremendous responsibility rests on the shoulders of the general practitioner in the prevention of this disease. Perhaps the most usual cause of periodontoclasia is a deposit of calculus on the tooth, pressing down on the gingival margin and finally being deposited under the free margin. Time and again, the periodontist sees cases in which the superficial calculus has been removed and the subgingival remains. The presence of subgingival calculus causes an inflammation of the area over it, which may be very slight, but nevertheless is evidenced in swelling and redness. It also frequently shows as a dark line along the margin of the gingiva. Every bit of calculus must be removed if the patient is not to develop periodontoclasia.

Equal in importance to the removal of calculus is accurate fitting in any dental restoration. The importance of this cannot be overemphasized. Margins of inlays and crowns must fit precisely, and that means that wax impressions must be taken precisely. When a mouth presents a red or purple area about a restoration which bleeds freely, we should take an explorer and note the margins, noting also whether any cement is left under the tissue. Decomposition of food particles on faulty margins is a frequent cause of infection leading to periodontoclasia. If the margins are perfect, we should note whether the contact is also.

If the teeth are naturally wide spaced and an open contact between certain teeth is normal to that individual, the impingement of food on the approximal gums may be borne without harm, but when, by reason of the movement of a tooth or the loss of proximal contours on adjoining teeth, a contact which formerly had been tight is opened, the proximal gum tissues are severely traumatized during mastication.[1]

Frequently, this type of traumatization leads to loosening and finally to loss of teeth. This is a condition which can and should be avoided by correct and well-fitting mechanical restorations. A well-made bridge, for instance, on a tooth standing alone will often act as a splint and hold the tooth firmly even though the tooth may be partly detached for an indefinite period. Of course, the tooth must be free of calculus and free of pus in order to be a good risk. This can be accomplished if the primary factor is the trauma.

We should note also whether the cusps are high or interfere during mastication. The blood supply of the gingival tissue is derived from the pericementum, from the periosteal blood vessels and from the alveolar gingivae. The fact of the blood supply being partly derived from the pericementum explains why there is so much congestion in traumatic occlusion.[2]

A trauma of the gums which is most difficult to control even with constant attention is that caused by malocclusion. Extreme overbite tends to produce a chronic gingivitis of the anterior gums.

2. Stillman, P. R., and McCall, J. O.: Clinical Periodontia, New York. MacMillan Company, 1922.

The responsibility of the dentist here is to educate parents to the need of orthodontia for these cases. In adults, when orthodontia can be of no avail, all that can be done is frequent polishing of the tooth surfaces and a stimulation of the tissue by massage.

The dentist must be familiar with the appearance of the gingiva in certain systemic conditions. Periodontoclasia is often caused by the breaking down of tissue resistance and the invasion of bacteria following if the systemic condition is not remedied. Bismuth and mercury cause a dark line about the margin of the gingiva which looks very similar to the shadow of subgingival calculus. A probe will tell the difference. Now that bismuth is so frequently used in the treatment of syphilis, we see the line more often. It is generally supposed that there will be no deposit of the metals in mouths which are scrupulously clean and have a high resistance. Nevertheless, I have seen these metallic deposits in mouths which have had painstaking care. In one case, a man had acquired syphilis and, becoming panicky about it, had used a great deal more mercury ointment than his physician had advised. The condition in his mouth greatly resembled a very acute Vincent's infection with much ulceration and necrosis. Moreover, quantities of Vincent's organisms were recovered from the ulcers. It must be remembered that Vincent's organisms are saprophytic and feed on any tissue breaking down in the mouth. An acute Vincent's infection must not be confused with underlying systemic conditions.

Another interesting case was that of a woman who had this purplish line after years of perfect mouth hygiene. Careful questioning elicited the fact that she had been using a hair tonic recently. This probably contained lead but may have contained bismuth. In very severe metallic poisonings, sodium thiosulphate hypodermically is indicated. In all cases, the patient should be referred back to his physician and the physician notified by the dentist himself. Another drug which frequently causes pain in the gingiva is phenobarbital (luminal), a drug frequently used in epilepsy.

Diseases which cause a metabolic disturbance, such as hyperthyroidism or hypothyroidism, diabetes and those diseases of other endocrine source, cause also a gingival disturbance.

Disturbances in diet such as those caused by too much protein also cause a gingivitis. Dr. James, of Chicago, has often found that patients consuming a large number of eggs over a long period have gingivitis. These systemic conditions cause a long continued disturbance of the gingival tissue which results in periodontoclasia. It is imperative that the diet be regulated so as to be well balanced.

It will be seen, therefore, that the responsibility for the prevention of periodontoclasia rests almost entirely on the general practitioner, as it is he who sees the mouth first. He must be thoroughly familiar with the appearance of normal gingival tissue so that he may recognize pathologic conditions when they occur, and he must be able to differentiate local from general systemic causes. On him there also devolves the responsibility for so constructing his reparative work that periodontoclasia cannot possibly result therefrom.

DISCUSSION

Mildred W. Dickerson, Washington, D. C.: The importance of Dr. Yeretsky's paper lies in the emphasis on prevention. When the general practitioner is so trained that he will recognize incipient periodontoclasia and the importance of diagnosing and removing its

causes, he will become as interested in relieving it as in doing a simple piece of restorative work. While the roentgen ray is quite necessary in making a complete mouth examination, in either incipient or more advanced cases of periodontoclasia, it can only reveal the extent of tissue destruction, and is of little assistance in determining the etiologic factors. It should be emphasized that only through a visual and digital examination of the periodontal tissues can the dentist determine the underlying etiologic factors and make a correct diagnosis and prognosis. In other words, the so-called diagnosis that accompanies the set of films sent out by the roentgenologist is of no value without a clinical examination. In regard to those cases of malocclusion in which the anterior teeth are not in contact, and the posterior teeth are taking the entire load of mastication, we have two exactly opposite conditions which bring about the same end result; namely, the loss of the supporting tissues. The condition in the posterior part of the mouth is due to excessive and incorrect function, while, in the anterior region, function is entirely lacking. Even an incipient case of periodontoclasia presents a condition of slow growth, and has been gradually developing over a period of considerable time, and should, therefore, be discovered before there is much deviation from the normal.

Israel S. Miller, New York City: Under the category of incipient periodontal lesions, we should include the effects of absence of teeth on the periodontal tissues. Considering for a moment what follows the loss and nonreplacement of a mandibular first permanent molar, for example, we find: 1. Partial function on the side of the missing tooth with lowered resistance in the gingivae to begin with. 2. Drifting of the remaining molars and also the bicuspids in the mandible, so that their long axes are inclined from the vertical. Loss of proper contact follows which permits food impaction and consequent irritation, infection and pocket formation. 3. Elongation of the opposing posterior teeth, their contact points being disturbed and food impaction occurring there also. 4. Occlusal trauma of the lower posterior teeth, because occlusal force is no longer directed parallel with the long axis of these teeth. This is further complicated by the uneven wear of the cusps of the teeth on that side. Pocket development is then quite rapid. 5. Great difficulty in the attempt to maintain hygiene on that side. Bacterial growth becomes profuse. Lowered resistance induced by their end-products takes place. It is possible to enumerate many other ill effects of the loss of teeth and their nonreplacement, but the foregoing are the most important results, having a direct bearing on the health of the supporting structures. When all dentists are impressed with the mutilation that takes place as the result of nonreplacement of missing teeth, particularly first permanent molars, their early replacement will be urged more generally than is the case now. I had occasion to refer a case to an exodontist of national reputation. On his return, the patient amazed me with the statement that the exodontist advised him against the replacement of the missing tooth. He was apparently impressed with this advice, for he refused to believe my warnings as to the consequences. In view of the fact that an injury has been done by such thoughtless advice, it seems to me that not alone does the general practitioner require education in this direction, but certain types of specialists as well.

A. H. Merritt, New York City: There is one point which I hope Dr. Yeretsky will enlarge on in her discussion; that is, the fact that the use of phenobarbital may cause gingivitis. I have never heard of that, and I would like more information on that point. The case of gingivitis that she referred to is sometimes called hypertrophic gingivitis of pregnancy, as though it were a distinct type caused by, and always associated, with pregnancy. This, I think, is a mistake. It should always be kept in mind that we may and frequently do have a hypertrophic gingivitis entirely dissociated from pregnancy. In the case shown it was so obviously the result of filth that I think we can rule out any other cause. Another interesting point emphasized was the fact that advanced periodontoclasia can be present in the mouth with very little evidence of it. The lesson to be learned from this is that we must be more careful in our examinations, for unless we are observing, many cases will get beyond control before they are discovered. Dr. Dickerson called attention to the fact that a diagnosis cannot be made from the roentgenograms themselves. A clinical examination is always necessary, though neither is

complete without the other. The question of missing teeth to which Dr. Miller alluded and which was emphasized by Dr. Yeretsky must also be considered. It is an important etiologic factor in many cases, because of the overloading of remaining teeth. The greatest problem in periodontia is the replacement of lost teeth in such a way as to relieve occlusal stress without at the same time injuring the remaining teeth.

Dr. Yeretsky: Dr. Merritt asked about barbital. I have seen only one case. The patient was about 50 years old and had had epilepsy only for two or three years. He was under what I understand is rather a routine treatment with barbital. When he came to me, his tongue was much swollen and very sore. It looked very red, but was not ulcerated. He was a farmer who did not practice very good mouth hygiene. The gingival tissue was much inflamed. I took his history, but not knowing anything about the action of barbital on the mouth, I did not pay much attention to it. I proceeded to clean up the mouth in the routine way and after the teeth were clean, expected these symptoms to subside. In the meantime, I had used a dye (methyl violet) which is used in cases of epithelial burns, and which I find promotes growth of new epithelium and relieves pain. The patient experienced some momentary relief, but he became steadily worse. The oral condition resembled an apthous stomatitis. He had a slight inflammation with a membrane which could not be wiped off as Vincent's can. In the meantime, I had taken smears, and had found a few Vincent's organisms, which will be found in the mouth in carcinoma or periodontoclasia; wherever there is tissue with lowered resistance. We therefore had to take into consideration many factors. I got in touch with the physician and as a matter of chance we decided to leave off the barbital. The patient improved rapidly. I see him now regularly. We had to keep on with the barbital to avoid the epileptic convulsions. We are trying to balance the treatment. We have gradually increased the dose of barbital, but the moment inflammation seems imminent, we omit it. Dr. Hirschfeld, of New York, has verified this. He has seen other cases so affected by administration of barbital.

Dr. Merritt: How much is this patient taking?

Dr. Yeretsky (closing): From 1 to 2 grains a day. I have never seen a case of hypertrophic gingivitis in pregnancy. I feel that pregnancy is no different from the normal as far as the mouth is concerned. There may be a difference in metabolism, which may cause a disturbance with lowered resistance of the gingival tissue. It is my feeling that periodontology is about as distinct from dentistry as medicine is from surgery. The two things are in a class by themselves, but they are as closely related as medicine and surgery. The periodontist must work with the general practitioner, and his work is useless without good mechanical restoration, and the mechanical restoration of the general practitioner is useless unless the periodontist can keep his patients' mouths in a healthy condition. The incipient lesions of periodontoclasia must be discovered by the general practitioner, and he must handle them as the internist must handle incipient conditions, which must be taken care of by surgery if they are not taken care of by the internist.

INFECTIOUS FACTORS IN GINGIVITIS AND THEIR RELATION TO THE DENTIST*

By ROBERT A. KEILTY, M.D., Washington, D. C.

THE purpose of this paper is to present to the dental profession a medical point of view on the infectious conditions operative about the necks of the teeth. In a previous paper,[1] before a mixed medical and dental group, I reviewed my concepts of this subject, and in a series of papers,[2] some of which have been published, I present the details and facts of the study.

The problem of gingivitis belongs to the dentist, since it concerns the preservation of the structures upon the care of which that profession is founded. It is certainly complex and takes into account facts well known to dentists but not even familiar in terminology to medical men. It is difficult, therefore, for the medically trained mind to evaluate the problem in complete ignorance of dental facts and terms. On the other hand, even well-trained dentists, as a class, must admit some ignorance of the dental pathology and bacteriology involved.

These two positions are not meant as an indictment, but are merely statements of fact. It is not advisable for the medical profession to become familiar with dental practice, but it is advisable for the dentists as a whole to know more about pathology and bacteriology. It is hoped that the researches in dental bacteriology which are now so popular will be even more strenuously pursued. I am making a plea that the maze of entangled facts, now known as the bacteriology of the mouth, be attacked by a mass of workers and the importance of each individual finding be thoroughly checked and evaluated. The subject will then be on a firm footing and not, as now, often merely held in erroneous opinion.

My own experience goes back to 1914, when Barrett first made smears from pyorrhea pockets at Allen J. Smith's suggestion and endamebae were recognized and reported in forty-nine consecutive cases. I saw the first smear and examined many mouths myself at that time. You are all familiar with the rise and fall of

*From the Pathological Laboratories of the Diagnostic Center, U. S. Veterans Bureau, Washington, D. C.

*Read before the Section on Periodontia at the Seventy-First Annual Session of the American Dental Association, Washington, D. C., Oct. 10, 1929.

1. Keilty, R. A.: Gingivitis: An Infectious Entity, from Medical and Dental Aspects, J. A. D. A., 17:271 (Feb.) 1930.

2. Keilty, R. A.: Present State of Our Knowledge of Gingivitis, J. Lab. & Clin. Med., 13:451-468 (May) 1928; Gingivitis II: Clinical Appearance of Gingivae in Different Forms and Stages, J. Lab. & Clin. Med., 14: 48 (Jan.) 1928; Gingivitis: Laboratory Methods for Study, J. Lab. & Clin. Med., 14:165 (Feb.) 1928; Gingivitis: Character of Exudate in Gingivitis, J. Lab. & Clin. Med., to be published; Specificity of Bacteria to the Bacteriolytic Action of Chemicals, with a Note on This Application to Chemotherapy, J. Lab. & Clin. Med., 14:539 (June) 1929; p. 539; Specific Chemotherapeusis with Relationship to the Bacteria Involved, J. Chemotherapy, 6, January, 1929.

Endameba gingivalis and the false premises regarding emetin as a specific in pyorrhea. This is an instance of erroneous evaluation of facts in the light of complete knowledge. On the other hand, the endameba is not a simple resident present in a large percentage of mouths but is a definite important pathogen. In this light, it must be rediscovered and again reckoned with for its proper value. It is not in any sense specific; a fact which Dr. Smith never did believe; but that does not mean that it is not pathogenic.

During the intervening years, I have pursued the subject more or less constantly, and I now have records of nearly 7,000 cases. This has given me an experience resulting in a varied contact with dental men which has been most enlightening for me, and which has caused me to change my evaluations as the facts become more and more definitely established. There is still much to be done, and I feel that I have hardly entered on the problem, owing to its complexity. In a series of papers, through the American Society of Clinical Pathologists, I am attempting to present the technical bacteriology of this experience, and it would seem to be the proper time to present the practical side to the dental profession.

In the whole work, there will be nothing startling, but certain well-devised procedures and facts gleaned from routine observations on a large number of cases along with experimental work will eventually satisfactorily solve the whole problem. The laboratory and the dentist must work together, for the present at least. This relationship may be permanent, or, when completely understood, may be so simplified that the dentist can handle the work alone.

In order to present as much as possible in the time allotted, I am going to summarize without comment, leaving explanations and details of controversial points to other papers. Inflammatory processes about the structures of the teeth are described under a multitude of names, of which the term "pyorrhea" is most commonly used. This has almost had its centennial and can be discarded. In view of the fact that most, if not all, of the inflammatory changes begin in the soft structures, I have included all cases under the short simple term "gingivitis." There are many other terms, possibly just as good, such as periodontitis and periodontoclasia, but they are not so expressive and do not lend themselves to qualifying adjectives as does gingivitis. All forms of inflammatory change in the gingivae, from the slightest marginal gingivitis through Vincent's infection to the most severe "pyorrhea" can be classed under gingivitis, acute, subacute or chronic, with expressive modifications, such as traumatic, exudative, ulcerative, suppurative, gangrenous, fibrous or recessive. This immediately simplifies a classification and gives a common ground for the etiology. The pathology of all these changes in the gums, the subgingival tissues, the peridental membranes and the bone is that of inflammation, in one or another of its manifestations, and to a degree comparable to the advance which the gross morbid changes indicate.

In the etiology of this inflammatory complex, bacteria play the most important rôle, since they invade not only the gingival sulcus, which is used as a medium of growth, but also the tissues themselves, which is more important in producing the actual inflammatory reactions in these structures. Of all the conditions which have been advanced as causative of these changes, the presence of bacteria *per se* is the most important. This is true not only from the standpoint of the pathologic changes present but also from

the fact that the inflammatory changes subside, and repair promptly takes place when the bacteria are eliminated.

All other conditions, some of which are now accepted as primary causes, are in reality secondary, in spite of the fact that they may be actual initiating factors in the disease. For example, there is no question that traumatic occlusion, by suddenly placing an abnormal stress on one or more teeth, allows an easy invasion of bacteria which otherwise would not take place. There is no question that the correction of traumatic occlusion will many times obviate an inflammatory reaction, removing the possibility of further invasion by bacteria, with a reparative effort on the part of the cell structures when the traumatism has been removed. While most mouths show a certain amount of traumatic occlusion, bacterial invasion will take place with or without traumatic occlusion, and will often involve teeth which show no evidence of such trauma. In this sense, I feel no hesitancy whatsoever in placing bacterial invasion ahead of traumatic occlusion as an etiologic factor, but I do give traumatic occlusion its proper importance as one of the initiating factors and one which may often continue as an important factor.

Much has been said and will be said concerning calculi, serumal or salivary, with sordes, tartar and film. Certain mouths tend to collection of sordes, or, we may say, débris deposits, about the necks of teeth, which tend to calcify in spite of careful mouth hygiene and frequent scaling. This is due, probably, to an individual chemical character of the saliva, with the proper hydrogen-ion concentration for calcium deposit.

These cases are very decidedly in the minority. By far the greatest number of cases showing deposits of calcareous material, either as the so-called serumal calculi beneath the gingival margins or as deposits in the interproximal spaces, where cleaning is not actually accomplished, are due to the natural deposition of calcareous material in necrotic exudation and débris which is acting as a foreign body. This phenomenon takes place all over the body. If the original exudate is cleaned out and kept clean, or if there is no reason for its formation, this type of deposit will not take place. As such, then, all types of calcareous material cannot be considered as etiologic factors in any sense but are the results of a condition present. They do continue as irritants when present.

Traumatic occlusion and gingival calculus are assumed by the dental profession today to be the two outstanding etiologic factors in gingivitis. I consider them both secondary in importance to bacteria.

Third and less important, although less understood, in the view of many writers is somatic influence in relation to local resistance and secondary mouth factors. Some men assume that general body chemistry, such as calcium phosphorus and glandular deficiency, and such general diseases as tuberculosis, syphilis and diabetes, present the sole causative factor in the development of gingivitis. This cannot possibly be true, else these factors would be present in 90 per cent of our population, which they are not. There is no question that a certain percentage of cases showing these deficiencies will show marked gingival changes. These gingival changes are a general part of the reaction, and while they are aggravated by the somatic condition, that condition is in no sense the sole etiologic factor in the gingivitis.

There are many other secondary conditions which have been presented as etiologic factors, and which, in individual

cases, do play some part, but which in no sense can be considered as the important etiologic condition in all cases of gingivitis. I refer to such things as smoking, gingival trauma in mastication, the present state of our prepared foods, which are soft and rich in their preparation, the accumulation of food débris, mouth breathing and acid mouth. In a certain group of cases with ill-fitting dentures, partial or complete, with poorly made crowns or crowns which have long since served their purpose, bridgework improperly applied, fillings of all kinds which are poorly finished, leaving, especially in the interproximal spaces, roughened areas or shelves, and dental caries, which fortunately is very decidedly on the decrease, one may find local reasons for a trauma which admit bacterial invasion in the same sense that traumatic occlusion plays its rôle.

Thus, after all is said on the various etiologic factors in gingivitis, by a process of elimination and a study of the accepted data on the pathology involved, bacteria must be given first place in the etiology.

What of these bacteria? Here controversy and lack of exact knowledge are frequent. In the "Manual of Bacteriology" (Bergey), forty-six different types of bacteria are described as occurring in the mouth. This does not include the entire number isolated by all workers. Of this number, I have records of the isolation of thirty-three different and distinct species, and I am sure that if time permitted, this number would be increased. Can one pick out of this any particular species or type of bacteria and consider it a specific etiologic factor? At the present time, in the records of my cases, certain bacteria repeat themselves constantly, but I do not consider in any sense that any are specific, unless it be the spirilliform and fusiform groups. These two types are present in almost 100 per cent of gingival exudates, are not present in perfectly normal mouths, are greatly increased in acute conditions, are much reduced in inactive conditions and clear up with complete disappearance in successfully treated cases. In this study, one must know what bacteria the perfectly normal mouth contains. This is most difficult or almost impossible since the conception of the normal mouth is open to a great deal of discussion, and what one considers normal, another may consider highly pathologic, and vice versa. I consider normal only the mouth which is absolutely perfect in its construction and absolutely free from gross morbid signs of inflammation. This makes up, in my series of cases, not much over 1 per cent.

Bacteria seen in fresh or stained smears and by culture vary within wide limits in a group of cases but are more or less constant in a given case. It will be seen from this that the gingival flora must be worked out for every case. It is here that the cooperation of the laboratory is essential. Certain groups are best seen by smear and others by culture. The fresh smear offers the best means of rapidly determining the major types of bacteria as well as any protozoa present. I have described methods in a previous paper. The spirilliform organisms under the general group of *Borrelia vincenti* are seen in their active form by fresh smear. They cannot be easily cultured, and until a method of culture is described, they had all best be grouped together as far as gingivitis is concerned. They are present in all forms of gingivitis and are probably the most important of all the groups.

The fusiform organisms are also constantly present and are best grouped under the heading of *Fusiformis dentium-Hoelling*. They are difficult to isolate in

culture and also require much further study.

The cocci may next be taken, as to both importance and frequency. These can be seen in smear but are best studied by culture, and routinely the blood agar plate picks out as many as any other single medium.

A large moist mucoid colony of staphylococci is a constant finding. This colony offers a symbiotic relation for several forms of staphylococcus, white and yellow, and for bacillary forms associated with the higher mycelia. The streptococci are quite constant, pigmented, nonhemolytic, plain hemolytic or with green hemolysis. The pneumococcus goes in waves. Several other types of easily recognizable bacteria appear on culture, but are not constant in every mouth. These are *B. catarrhalis, B. coli, B. diphtheria, B. hofmannii and B. influenzae. B. acidophilus* is recognizable in smears quite constantly, but is not brought out on blood agar plates easily. Many other forms, such as rosettes or actinomycetes, short vibrios and long mycelia, singly and in multiple branches, are more or less common. The yeasts, saccharomycetes and monilia are only very occasionally seen but may be frequently obtained on culture.

The protozoa *Endameba gingivalis, Trichomonas buccalis,* bodo and occasionally giardia and cercomonas are the types that I have so far encountered. These organisms, as already stated, are not mere benign residents in dirty mouths, but are part and parcel of the gingivosulcal exudate. If they do not invade the tissue and if they do not produce a toxin, both of which are highly probable, they at least act as distinct local irritants. I can say definitely that as long as they are present, a gingival reaction will not entirely clear up.

I have tried to present a concept that all forms of inflammatory changes in the structures about the teeth are to be considered as one entity and spoken of under the general term of gingivitis. This includes everything from simple marginal gingivitis to the most advanced "pyorrhea," along with acute exudative and gangrenous changes now known as Vincent's infection. Such a concept will simplify the whole situation, and the bacterial flora becomes the most important study in every case. It is necessary to enumerate all bacteria and protozoa present in quantitative terms in every case. These findings are not only important from the point of view of knowledge to be gained, but also must be known if intelligent treatment is to be carried out. By intelligent treatment, I mean a plan of treatment mapped out beforehand and based on the conditions present in a given mouth, correcting each and every condition by a specific line of attack as nearly as the present state of our knowledge will allow.

This attack implies that every case must be individually studied from the dental, roentgen ray and pathologic aspects and every possible angle corrected. The laboratory must aid in the pathologic and bacteriologic study and the dentist must carry out the procedure based on this study.

In the correction of dental mechanics, the dentist, of course, is guided entirely by his training and experience. In the correction of deep-seated dental disease as developed by the roentgen ray, the oral surgeon must be guided by his training and experience. In the same way, the correction of bacteriologic factors, now so universally neglected, must be guided by the training and experience of the bacteriologist. When all three of these trained groups are utilized, the end-re-

sults for correction and maintenance of a perfect mouth are such as cannot be obtained by any other line of attack.

Time does not permit my attempting anything on treatment in this presentation. It has been necessary to devote considerable study to this phase of the subject, in order to obtain facts on bacterial reactions. Fortunately, we have a number of quite specific drugs which can be directed against predominance of bacterial factors present in a given case. It is the combined use of the proper drugs in a given case which constitutes the bacterial side of intelligent treatment. One of the most important phases of the whole subject is the use of a pretreatment stage in all operative work in the mouth. I have not seen a postoperative infectious reaction in a single successfully pretreated case in years. I have seen many postoperative infections during the same time, in which the preparation of the patient did not take into account the actual bacteriologic factors in that mouth by a specific preoperative chemotherapeusis.

CONCLUSION

Gingivitis represents an inflammatory entity now known under a variety of names, from acute Vincent's infection to pyorrhea, which is subject to a precise and accurate terminology based on the pathologic process which is present.

Considered as such an entity, bacteria play the most important part in the actual etiologic rôle.

It is possible to maintain a study of these bacteria, but owing to their technical complexity, it is necessary to have the aid of a bacteriologist until methods of procedure can be further simplified.

Such a complete bacteriologic study allows a plan of intelligent and quite specific treatment mapped out on the findings in a given case, which can and should be carried out by the dentist in addition to the correction of purely dental mechanics.

DISCUSSION

Israel S. Miller, Jersey City, N. J.: Dr. Keilty has made a contribution to our clearer understanding of periodontal disease with the report on thousands of smears proving that the fusiform bacillus and the spirillum of Vincent are the predominating bacterial destructive agents and not the streptococcus and staphylococcus, as has generally been claimed, but without sufficient proof. I have therefore found it helpful to employ Fowler's solution (solution of potassium arsenite) combined with liquor antisepticus alkalinus in the proportion of 3 to 1 (one tablespoon in one-half glass of warm water), as a swab of the teeth and mouth before operating, and as a mouth wash. The arsenic in Fowler's solution is considered a specific for the spirillum; and the other ingredient, destructive of the fusiform bacillus. Tincture of green soap in solution may be employed also. I employ this in addition to the regular clinical procedure in the treatment of periodontal disease, which I call the standardized periodontal procedure. This consists of six steps: (1) diagnosis; (2) balancing occlusion; (3) instrumentation; (4) tissue stimulating; (5) planning restorations; (6) return for regular prophylactic treatments. There is another point that has been illuminating to me: Dr. Keilty finds that a normal mouth does not contain the Vincent organisms. This fact when clinically applied means that the operator must take smears during and after treatment of all types of periodontal disease in order to make certain that he has eliminated these organisms. Unless two or three negative smears in succession are obtained, the mouth cannot be called normal, regardless of how beautiful the tissues look clinically. I endorse Dr. Keilty's advice to dentists to cooperate with the pathologist in their treatment of periodontal disease.

Wilhelmina Yeretsky, Grand Rapids, Mich.: I agree with Dr. Keilty that a perfectly normal mouth does not harbor Vincent's organisms, the spirochete or fusiform. I have not run through the series of smears that Dr. Keilty has, but in a series of perhaps a hundred, we have never found those organisms in perfectly normal mouths. The difficulty was in finding normal mouths, but the men,

particularly the physicians and the laboratory man, were not familiar with the appearance of pathologic gingival conditions, and made the broad statement that there were always fusiform bacilli and spirochetes in the mouth, because they did not recognize the pathologic conditions. I always take my own mouth smears from the superficial and buccal membrane and also from the pockets before sending them to the laboratory for diagnosis. Dr. Miller says that he also finds Vincent's organism in the periodontal lesions. I have had the interesting experience of finding, in young people, 22 or 23 years old, the pocket extending the entire length of the root, two-thirds of the way or completely around it. The roentgenogram showed a tremendous amount of bone gone, when we consider the age of the patient in these cases. In these pockets, I found a pure smear of Vincent's organisms. I feel that that destruction of bone is due to infection from Vincent's organisms, in younger people. I do not think that we find them in older people. They have the more usual forms of organisms in the periodontal pockets.

R. A. Adams, Denver, Colo.: As a practitioner who limits his work entirely to periodontoclasia, and speaking to general practitioners, let me say this: Do not become perturbed at what you have heard. Go back to your office remembering the other things that you heard yesterday and today; follow them out, and you will get results. Do not be discouraged. Most of the paper is true, as far as that is concerned, but there are other truths. Go back to your offices with the determination to recognize periodontal lesions in their incipiency, and treat them as you have been instructed to treat them, this morning and yesterday, and you will get results, without cooperation with the bacteriologist and the pathologist. I am telling you this because for more than twelve years I have not had a drop of medicine on the bracket in treating chronic cases of these diseases. We get results in chronic cases especially, and the only case in which I use medicine is in acute involvements. To get results, cooperation with a bacteriologist is not especially necessary. Treat these lesions as you have been taught in our textbooks. The bacteriologist is not imperative to your success in treating these cases. If it is convenient, and you want this service, I have no objection. But if you practice the things you heard yesterday and this morning, and that are constantly appearing in our periodicals and textbooks, you will get results.

H. W. Krogh, Washington, D. C.: I speak from the point of view of the practitioner and not the bacteriologist. The bacteriologic examination of my patients is made by Dr. Keilty, and he is the biggest single aid in my practice. Much harm was done in the treatment of periclasia by subgingival medication because the thought was given out that it was only necessary to medicate these cases and they would promptly clear up and remain so; that scaling or attention to restorations, or any of the things that we were accustomed to doing, was unnecessary; just pump in the drug and all would be well. That was not all by any means. If one does all that Dr. Adams just spoke of, using Dr. Keilty's technic, one will really get results. I did not agree with Dr. Keilty when he said that if these cases are cleared up bacteriologically, they will always clear up clinically. That is not always true in my experience. In those cases in which the result is not good, I usually dissect the pocket according to Ward's technic. Nor do my patients all get relief from calculus. The relief from calculus is astounding in the cases that are kept clear, and also freedom from decay and all other unpleasant things found in the mouth, but, in certain cases, the calculus will reform, not so rapidly, but it will come back. Even in those cases, the gingival inflammation which accompanies large amounts of calculus will not be so marked. If one has no convenient laboratory and cannot have a chemotherapeusis worked out, the use of a combination of metaphen and acriflavin, in combination with arsphenamin, will give excellent results. There will be probably 5 per cent of cases which will not clear up. I do not mean to say that it is possible to clear up bacteriologically 100 per cent of the cases, and I think some of the failures may be due to the mechanical difficulty of getting the drug into the pocket. Nor should the impossible be attempted. Extract about the same teeth that you would otherwise—the multirooted teeth with bifurcation involvement, and single-rooted teeth which are retained by less than one-third of their roots. It is often possible to clean up these teeth, but I doubt that they can be kept clean, and to my mind that is the big problem. Arsphenamin in glycerin is the biggest single adjunct that I have. No mistake will be made by

using it routinely. Another thing about arsphenamin: it does not distintegrate over night. Arsphenamin and glycerin will remain effective a long time if chemically pure glycerin is used. In advanced cases, the surgical treatment may be best from a bacteriologic point of view because then the gingival crevice is eliminated and there is less possibility of reinfection. In regard to postoperative infection: I have seen some areas break down afterwards but the cases of dry socket will be reduced approximately one-half. Operative areas heal promptly even after removal of badly impacted lower third molars. I still retain much of my undergraduate prejudice against emetin, and I have not fully accepted Dr. Keilty's ideas regarding the endameba.

Dr. Keilty (closing): I am trying to present a concept without controversy. This is difficult, giving, as it does, the bacteria a very important place, and realizing that other things may also have a very important place in any given condition. In my first paper on gingivitis, there are some controversial things that I am not entirely in agreement with at the present time. This is due to progress. One must have an open mind on this subject as we go along, and evaluate facts as to results received. Dr. Miller mentioned the organisms of Vincent as of first importance, and the streptococcus second. The borrelia is very important from the standpoint that they are active bacteria, they are irritants locally and not very pathogenic when it comes to the invasion of tissue. On the other hand, the streptococcus is not very active in the motile sense, but if it ever gets into the tissue, it becomes responsible for the secondary manifestations. Dr. Yeretsky spoke of taking smears. I have been trying to interest the bacteriologists in studying this subject more exhaustively. As she has said, a slide stained for Vincent's organisms in most cases is reported as positive. The problem is not so simple because little is known about these organisms. The spirilliform types have never been successfully cultivated, while the fusiform group are still in a foggy state. There is a great deal to clear up. You may make your own smears, but the results will depend on your initiative and training. If you can get your bacteriologist interested, there is a wonderful chance for cooperation. As regards Dr. Adams' remarks, I do not wish to discourage anyone. I am not an alarmist. There is not anything to be alarmed about. I did not have anything startling. I wish I did have. I wish I could come to you and say, "This is a specific thing, this is the cause." Please do everything, Dr. Adams, that you have ever done. Please do one more thing; take into consideration the bacteria. If you will add that, instead of getting 75 per cent results, you are likely to get 100 per cent. Dr. Krogh brought up some points on treatment. I could not go into this phase because of its length. I would like to leave a thought on the use of arsphenamin. Use this drug locally, and remember that intravenously arsphenamin has absolutely no action on the spirilliform organisms in the mouth. No matter how acute or what type of case, you cannot influence it by the use of arsphenamin intravenously; it must be used locally.

THE PREPARATION OF TEETH FOR PORCELAIN JACKET CROWNS*

By J. E. ARGUE, D.D.S., Seattle, Wash.

THE preparation of teeth for porcelain jacket crowns should be given the greatest consideration to assure the future health of the tissues involved and also the maximum support of the porcelain against the occluding stress of mastication. We should therefore have a thorough knowledge of the anatomy and histology of the teeth and their surrounding tissues.

I shall review briefly and only in part the anatomic and histologic relation of some of the tissues that we should be most concerned with in the preparation of the tooth for a porcelain jacket crown.

Anatomically, a tooth consists of three parts: the crown, root and the neck. The crown is the exposed part, or that part of the tooth that, with its color and form, gives the artistic expression. The roots, which are curved somewhat and are conical, are encased in the alveolar process of the maxillary bones of the face and are held in place by the ligament attached to the peridental membrane. The neck is located where the enamel of the crown ends and the cementum that covers the root begins. This point is known as the cemento-enamel junction.

Histologically, we have to consider the enamel, dentin and cementum of the hard tissue variety, and the dental pulp, peridental membrane and the mucous membrane, of the soft tissues. (Figs. 1 and 2.)

Peridental membrane is vascular and fibrous, being very similar to the periosteum of bone,and having a minute nerve and blood supply. Its fibrous structure consists of white and yellow elastic connective tissue which is arranged in bands attached to the bone of the inner surface of the alveolar process and extending over and ending in an attachment in the cementum; this forming a strong yet somewhat flexible attachment for the teeth and holding them firmly in the sockets of the alveolar process of the maxillary bones. (Fig. 3.)

The mucous membrane that covers the alveolar process and makes up the greatest part of the gingival soft tissue consists of stratified squamous epithelium beneath which is a layer of connective tissue containing some elastic fibers. Its surface is covered with numerous papillae, varying in size.

This membrane, which is attached by alveolar connective tissue to the periosteum, is known as the submucosa. In this layer, the small racemose glands, which secret mucus, are located. The submucosa contains the larger blood vessels which give the blood supply to the mucous membrane, and also contains lymphatics. (Figs. 4 and 5.)

The mucous membrane extends over the free end of the alveolar process,

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where it folds upon itself, encircling the teeth, and festooning itself in graceful curves in accordance with the curvature and convexity of the surfaces of the teeth. It forms a free edge, varying in length and known as the gingivae. (Fig. 6.)

The internal surface of this fold is attached by fibers arranged in bands of peridental membrane which run in a transverse, oblique and circular direction, delicately attaching the gingivae to the cementum at the necks of the teeth.

The length of the gingival soft tissue varies greatly at different ages of individuals. At the age of 15, the normal gingivae covers nearly the gingival fourth of the crowns of the teeth, and, beginning at this age there is a progressive recession of this gingival tissue to old age, the greatest recession taking place between the ages of 15 and 30 years.

At the age of from 45 to 50, the gingivae has, in most cases, receded to the cemento-enamel junction, and at the age of 60, the cementum is exposed, this exposure progressing in after years to from nearly one-fourth to one-third the length of the roots of the teeth gingivally.

The gingival tissue is a very sensitive and susceptible tissue to any irritant. It will not tolerate any injury to its attachments or any roughness on the surfaces of the teeth beneath the free edges of the gingivae. This causes it to become irritated, and an acute, or a subacute, inflammatory condition of the peridental membrane and mucous membrane of the gingival soft tissue soon develops.

Therefore, in making porcelain crowns, we must have a fundamental knowledge of these hard and soft tissues, and consider only the procedure that will maintain and conserve the life of the pulp and the health of the gingival tissues.

Fig. 1.—Histologic relation of the enamel, dentin and cementum; showing the cementum covering the short rods of enamel at the cemento-enamel junction. (Figures 1, 2, 4, 5, 6, and 7 from Noyes' Histology and Embryology.)

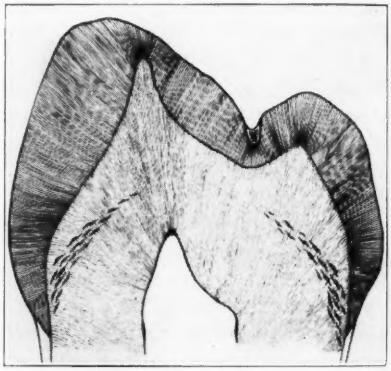

Fig. 2.—Histologic relation of the enamel, dentin and cementum; showing the cementum covering the short rods of enamel at the cemento-enamel junction.

In the first place, we should take care in operating to observe the recessional lines of the horns of the pulp; not to cut too deeply into the teeth, which might cause death to a healthy pulp; not to do any injury to the gingivae or its attachments, and not to carry the shoulder of the preparation any farther than just well under the free edge of the gingivae.

Make this a rule, and when the normal recession takes place and the joint becomes unsightly, reoperate, carrying the shoulder just under the free edge of the gingivae.

In this way, the least possible irritation is caused to this tissue, and if the operation is carefully followed out, little

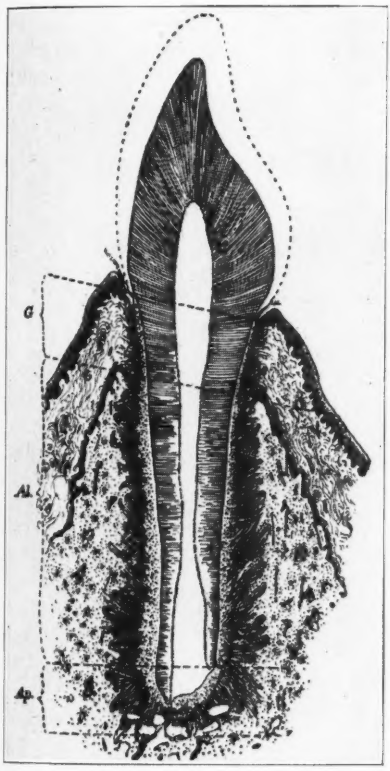

Fig. 3.—Arrangement of the fibrous bands of the peridental membrane.

if any abnormal recession will take place around shoulder crowns, provided a well-adapted crown, without overhang, is made.

Some porcelain operators have recommended the entire removal of the enamel to the cemento-enamel junction and extension of the shoulder to this point under the gingivae, stating that, on account of the normal recession, this is the proper procedure to insure more lasting results.

This sounds very well, theoretically, but when we stop to consider the anatomy and histology of the hard and soft tissues and their relation to one another, what a grave error it is seen to be.

Fundamentally, the enamel below the gingivae should not be disturbed in any case of a young patient, for the reason that the permanency of any operation depends only on how the health of this gingival soft tissue is maintained.

It does not make any difference how careful an operator may be, when the enamel is removed the cleaving instruments sever the delicate transverse, circumferential and oblique ligaments so lightly attaching the gingivae to the cementum that extends up over the short rods of enamel at the neck of the teeth, and thus doing an untold injury to the soft tissues and roughening the cementum, with the result that the gingival soft tissue is irritated.

The only wise procedure, then, in young patients, is to leave this enamel under the gingivae intact, as Nature has provided a contour that gives the least irritation; maintaining a fulness of the gingival tissue that cannot be reproduced by the hand of man; dealing with it in accordance to the age of the patient, and extending the cavosurface angle of the shoulder just under the normal gingivae.

Porcelain, when properly baked to give a glazed surface where it comes in contact with the soft tissues, has the least irritating effect of all materials that are used for restoration in dentistry. It is a very hard and fragile material, and will

fracture under occlusal stress if it is not properly supported.

In preparing teeth, a definite standardized form should be made that will give ample support and anchorage to it for maximum resistance against stress; also a form which, when a matrix is accurately adapted to it, can be removed without distortion.

It requires development on the part of the operator to acquire a definiteness in cutting and instrumentation and thus to successfully perform the required fundamentals in this class of dental operation. (Figs. 7-10.)

The standardized form consists of a shoulder less than 0.5 to 1 mm. in width, varying for the different teeth, cut at right angles to the axial surface to give resistance to stress and extending the entire circumference of the tooth, following the curvature of the gingival line.

The axial surface extends the entire circumference of the tooth mesially, lingually, distally and labially or bucally. It is formed by removing the remaining enamel on those surfaces to the gingivae and, when completed, should have the general form of the crown of the particular tooth operated on, with rounded angles where the surfaces of the teeth meet, as any acute angle to a surface would give a cleavage to the porcelain and weaken the crown at that point, which would render it more possible for the porcelain to fracture under stress.

Where the axial surface meets the gingival surface of the shoulder, there should be a definite acute angle to give resistance and anchorage to the porcelain.

The incisal or occlusal surfaces vary greatly in form, for the reason that necessity demands that thickness be given the porcelain on this surface, bulk of ma-

Fig. 4.—Arrangement of stratified squamous epithelium of the mucous membrane.

terial to sustain amply direct occlusal stress, yet we cannot grind too deeply over the horns of the pulp, but must leave a thickness of dentin to afford these delicate parts protection from thermal stimulation.

This incisal or occlusal surface, like the axial surface, should be given the general form of the tooth operated on, all angles being rounded to insure the greatest strength to the porcelain.

The occlusion should be carefully studied to fix in mind the amount of grinding that is necessary at this point. The rough angles of the opposing occluding teeth should be ground and smoothed. (Figs. 11 and 12.)

The cutting is begun by using three-fourth inch carbo disks run at high speed, with a stream of water thrown on the tooth; cutting off the mesial and distal surface to the gingivae, and using a size one-half carbo disk to remove the incisal or occlusal surface. A No. 243-244 Miller stone disk is then used to remove the lingual and labial or buccal enamel.

A five-eighths inch concave carbo disk is used to remove the enamel at the mesio-

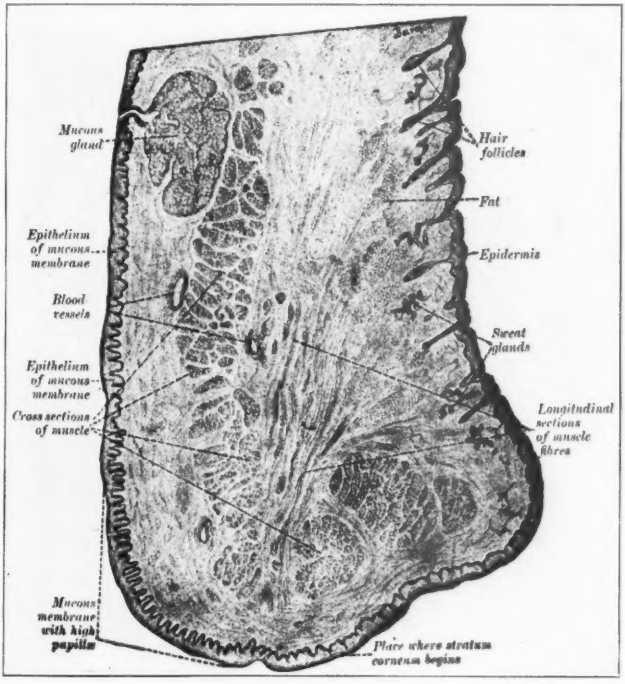

Fig. 5.—Mucosa and submucosa containing the glands and blood vessels.

PROCEDURE OF PREPARATION

The tooth to be operated on should be examined for vitality. A suitable anesthetic may be used to desensitize the tooth and gingival tissue.

labial or buccal angle, the distolabial or buccal angle, the mesiolingual and the distolingual angles.

At intervals, the tooth operated on should be dried, and examined with the binoculars to check up on how deep we are cutting. The final grinding should be done without water, compressed air being used to reduce frictional heat. This allows the operator to see exactly what he is doing.

A No. 229 or 240½ Miller stone disk is then used to cut through the enamel at the labial or buccal and the lingual surface, near the gingivae.

Care should be exercised not to go under the gingivae with a stone as it is impossible to do so without causing injury.

The binoculars should be used throughout the shoulder preparation, as it aids to produce the definite result which is of so much importance.

At that point, the preparation is ready for the definite forming of the shoulder, which is cut and carried under the free edge of the gingivae with a smooth fissure bur, No. 56 or 57. I recommend the right angle bur in a straight handpiece on all anterior teeth. This enables the operator to place the second finger on the tooth operated on, or the adjoining teeth, so that the bur can be held steady,

Fig. 6.—Relation of the gingivae to the tooth; showing the arrangement of the mucosa and submucosa layers and delicate fibrous attachment to the cementum at the cemento-enamel junction.

and in the right angle or contra-angle handpiece for the posterior teeth.

Cutting should be started at one given point and carried under the gingivae, the cutting of the shoulder being completed as we progress around the tooth.

A stream of compressed air should be used throughout the burning operation, giving a clear field and keeping down the friction of the bur.

In operating on teeth difficult of access, the rubber dam may be placed. This, when properly adjusted, holds the lips, tongue and cheek out of the way, and a suitable rubber-dam clamp can be applied to press the gingival tissue back, which gives the operator complete access in forming the shoulder. The rubber dam is not placed until all the grinding is done.

To mark just how far below the gingivae the shoulder should extend, a nick is cut lingually and buccally with a No. 36 Miller disk, so that when the gingivae is pressed back with the clamp, we have a definite check showing how far to extend the cavosurface angle of the shoulder gingivally.

The class of teeth difficult of access includes all upper teeth back of the first bicuspid and all the lower teeth, and I recommend that in at least 95 per cent of this class, the shoulder should be formed with the aid of the rubber dam.

When the use of the bur is completed, a No. 229 Miller stone is used to correct and finish the axial surface, also the detail of the incisal or the occlusal surface.

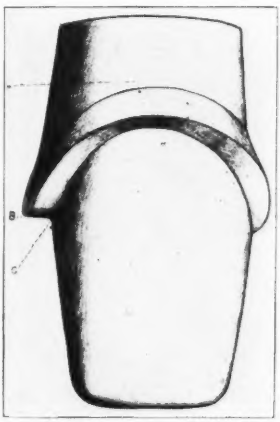

Fig. 7.—Labial view of a prepared incisor. *L*, labial surface; *B*, bevel of the cavosurface angle of the shoulder; *G*, gingivo-axial angle.

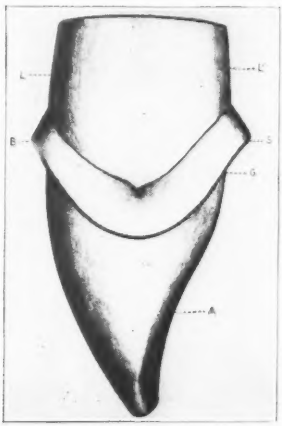

Fig. 8.—Mesial view of a prepared incisor. *L*, labial surface; L^1, lingual surface; *B*, bevel of cavosurface angle of shoulder; *S*, shoulder; *G*, gingivo-axial angle; *A*, axial surface.

Nos. 5, 6 and 9 hoe excavators are used to smooth the shoulder to a definite form, and if the patient is at an age at which the enamel is left, a slight bevel should be given to these short rods, completing the preparation.

If the final operation has been completed with the rubber dam in place, it would be advisable, after the rubber dam

is removed, to check up on the occlusion to see whether the proper space between the occluding teeth has been allowed, to establish the necessary bulk of porcelain and to sustain the occlusal stress. If not, it should be ground by a No. 78 Miller stone to correct this.

Pulpless teeth in a comparatively healthy condition and on which it would be advisable in any case to place a porcelain jacket crown, are a problem that we should consider carefully.

The dentin of such teeth is rendered more brittle, and also there has been more or less of a loss of dentin by caries which reduces in that tooth the ability to support a porcelain crown. I would advise that posts be fitted in the root canals of pulpless teeth, combined with a gold casting to restore the loss of dentin.

The wax pattern should be made to restore the axial, incisal and occlusal surfaces, and this is made and cemented in place before preparing the tooth.

Preparation is made in the usual way.

The gold casting restores the lost tissue, which makes it possible to establish the proper form to the preparation for a porcelain jacket crown. This, combined with the posts in the root canals, reinforces the tooth so that it can more readily stand the direct occlusal stress.

DISCUSSION

W. D. Vehe, Minneapolis, Minn.: The knowledge gained from experience is cumulative. In the case of the porcelain veneer crown, our experiences with this remarkable restoration must teach us certain things not alone from the standpoint of comfort and serviceability to the patient but also, more fundamentally, from that of the health of the tooth and the surrounding parts. This knowledge, in turn, should temper our judgment, making it more rational, and thus assuring our patient an increasingly superior service. Sound principles of practice demand the closest consideration for the health and comfort of the pulp and soft tissues. Dr. Argue emphasized this in the preparation of a tooth. He pointed out the possibility of encroachment as far as the recessional lines of the horns of the pulp and stated his position on

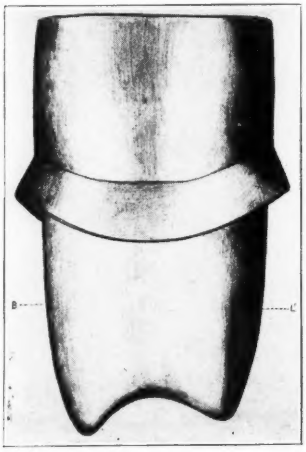

Fig. 9.—Mesial view of prepared incisor. *B*, buccal surface; *L*, lingual surface.

Fig. 10.—Mesiobuccal view of prepared molar.

the width and placement of the shoulder, a view to which little exception can be taken. This seems to be particularly apropos in the teeth of younger people and in all hypersensitive teeth in people of all ages. Naturally, all patients do not have such a condition to contend with, but, usually, these teeth are comparatively insensitive, so much so in fact that little discomfort, and in some cases none at all, is felt during the preparation of the tooth. It would seem that, in these cases, one may safely take greater liberties to obtain proper thickness in the crown for strength where it is required and to place the shoulder more securely under the free gingival margin. At least, this is my policy. On the other hand, this is not an operation that can take the place of orthodontic treatment in mild irregularities of the teeth except in very limited well-selected cases, and it never was primarily intended for such procedures. The future health of the gingival tissues is so important not alone from a hygienic standpoint, but also from that of esthetics. Great care in making the preparation, so as not to lacerate these delicate tissues, is absolutely necessary to insure these conditions. An accurate margin is also essential. The width the shoulder should be has been well presented. The condition and size of the tooth have much to do with this. Experience seems to emphasize a good width of shoulder and bulk of porcelain as initial essentials for security against breakage. There are other factors that must be included in incorporating the most into a crown from the standpoint of strength that do not come into our present discussion but which must not be lost sight of. The beveling of a shoulder margin might be questioned. The histology of the enamel in this region is so well understood that the desire for beveling it is apparent. The porcelain margin is delicate also, presumably being on a par with the enamel in that respect, even though they are dissimilar structures. An attenuated, acute-angled margin on either the porcelain or the enamel would easily be liable to fracture; and to most safely protect both of these margins, it seems logical that right-angled margins would give the greatest possible protection to both structures. An even thickness of porcelain throughout the crown requires the removal of all the enamel of the tooth except beyond the shoulder. In the cases that manifest tooth wear, and where there is tissue recession, more than the usual requirement must be removed. Beginners and students quite regularly do not remove sufficient tooth structure to allow for an even thickness of porcelain in the completed restoration. The preparation is made irregularly,

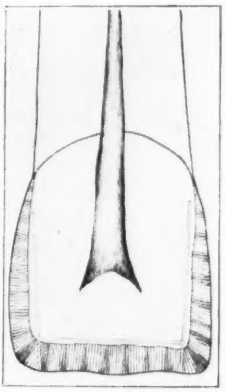

Fig. 11.—Labial view showing how the mesial and distal cuts at the dentino-enamel junction are made with a three-quarters carbodisk.

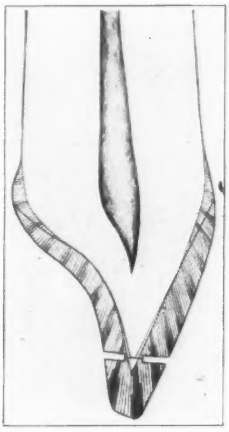

Fig. 12.—Labial and lingual cuts made on an incisor with a size one-half carbo disk.

many times so that there are thick and thin spots in the work, and thus weak and strong areas are produced. Then, also, color many times is impaired, and the natural structure cannot be worked out without impairing the future safety of the crown. The outline of the dento-enamel junction, or, in other words, the shape of the dentin with the enamel removed, is such that it enables one to make quite parallel walls on all axial surfaces and plane walls on the incisal and occlusal surfaces that can be placed more or less at right angles to the directions of stress. Technic is a method of procedure and as such is only a means of accomplishment. It should never be distorted to mean anything but a means to an end. No two men work exactly alike

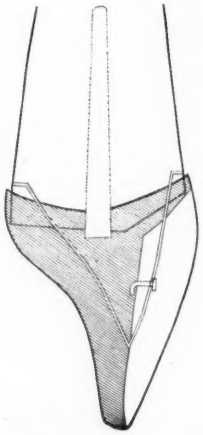

Fig. 13.—Case in which a Richmond crown has been used and recession of the gingivae has taken place. The regular preparation can be made as outlined, correcting the esthetics and establishing a healthy joint at the gingivae.

and that primarily is not so important. The main point should be the end desired, and when that can be agreed on and accepted, standardized methods of procedure are bound to result. Dr. Argue's technic has been well worked out indeed. He is to be commended on his safe and sane principles of practice. The patient's interests become our first duty. It is not a question of the consideration of our own comfort and convenience except as and until these interests are not violated.

C. O. McBean, Los Angeles, Calif.: Dr. Argue has wisely cited first the absolute necessity of a complete knowledge of the tissues in the operative field, both histologically and anatomically. The acquisition of this knowledge by the operator cannot be stressed too emphatically, for any surgeon attempting to operate on soft or hard tissues, or both soft and hard tissues, without this knowledge, is subjecting the patient to more than the possible failure of the operation.

The operator should fortify himself with a good set of roentgenograms, which he should study minutely, as to the pathology of the tissues in the operative field, and also their anatomic relation in order to determine whether the tissues are all in harmony with the forces applied in function.

The next procedure should be the study, clinically, of the supporting tissues and of the anatomic relation of the tissues to the forces of function.

Any tooth rotated, or in lateral relation to the arch, cannot be successfully operated on without consideration being given to this factor. All surfaces of the opposing and adjoining teeth should be inspected closely, and marks of abrasion studied and charted. The plane of the abraded surfaces or cusps determines the angle at which the forces of mastication are imparted to the tooth. The porcelain restoring this portion of the tooth should be supported by a seat prepared at right angles to this force. In the restoration of the anterior teeth, Dr. Argue advocates the reducing of the stump as much as a third on the incisal aspect in order to permit of a bulk of porcelain sufficient to resist the forces imparted to the restoration in the act of biting.

It is a well-known fact that a thin veneer of porcelain has greater strength, when properly supported with a flat seat at right angles to the line of force, than a greater amount of porcelain, improperly supported. Were this not true, the Davis and Logan crown of the past would never have fractured.

On study of the forces applied in the act of incising, we find that force is contributed to the incisal aspect of the working teeth, when the lower jaw is in the protrusive relation, and then, as the teeth pass back into centric relation, force is contributed to the incisolingual third of the tooth, the force passing through the tooth toward the gingival margin on the labial aspect. If the

patient is biting food of a resistant nature, such as the crust of a French roll, and then, in order to assist in the incising, produces leverage with that portion of the roll grasped in the fingers, a force is produced which passes through the bulk of porcelain restoring the incisal third, and is added to the thin plate of porcelain restoring the labial third, and all too often fracture will result. The fracture will occur at the point of greatest curvature on the labiogingival plate of porcelain, and a small, crescent-shaped piece of porcelain will be fractured out. It would therefore seem more advisable to reduce only the incisal portion of the stump, about 1.5 mm., thereby producing a support to the porcelain in this type of force. The point made by Dr. Argue in reference to the preparation of the gingival seat or shoulder cannot be stressed too emphatically. On close examination of the junction of the cementum and enamel, it is found that the cementum folds up over the enamel, and, as the peridental membrane is attached to the cementum, one can readily see that it is impossible to remove all of the enamel. An attempt to do so will irreparably injure the peridental membrane. Therefore, as Dr. Argue states, when the tissues are all in normal relation, the shoulder should be prepared just beneath the free margin of the gum, and not at the cemento-enamel junction. The attempt to prepare the shoulder at the cemento-enamel junction necessitates the removal of all of the remaining enamel, and this procedure is not only an unnecessary destruction of tooth tissue, but endangers the future vitality of the pulp. By preparing the shoulder just beneath the free margin of the gum, it is possible to retain a thin veneer of enamel covering the dentin on all surfaces of the stump, except the two approximal surfaces, thus affording the pulp the maximum protection and also maintaining the maximum strength which the enamel imparts to the stump. If all the enamel is removed, the dentin, which is slightly elastic, will give, under stress; while the porcelain, which is inelastic, does not give, and, therefore, fracture is likely to occur. If the supporting tissues have receded so that the cemento-enamel junction is exposed to view, a better esthetic operation is obtained by preparing the shoulder at the cemento-enamel junction, but under no circumstance should the shoulder be prepared farther apically than the cemento-enamel junction. The preparation of the shoulder apically of the cemento-enamel junction will cause unnecessary destruction of tooth tissue, and also cause an encroachment on the pulp, to the point of grave danger to the future vitality of the pulp, as well as producing a weak stump for the restoration. The instrumentation in the preparation for a porcelain jacket crown involves largely the personal equation, for many operators who have acquired the proper amount of skill will work with excellent results with stones, fissure-burs and end-cutting burs. Others confine their instrumentation to the use of stones of the proper sizes and shapes, and they also will carry the shoulder beneath the free margin of the gum, without lacerating the tissues, even to the point of one drop of blood. In operating on the enamel, stones are much more easily controlled, and will also cut very much faster than a rotating steel instrument. As was stated, in operating with stones, a cool blast of air should always be directed on the stone and tooth, to prevent overheating. In preparing the shoulder and carrying it beneath the free margin of the gum with stones, the blast of air should be directed at such an angle that the free margin of the gum is held out, away from contact with the stone. The final finish of the shoulder is made with a hoe chisel, and the rest of the stump is finished with fine disks, and polished. With a complete knowledge of all the facts, as brought out by Dr. Argue, all that remains for one to avail himself of this valuable type of restoration is to take any one of the several technics which give due consideration to the laws of physics and chemistry as they are applied to ceramics, and practice the technic sufficiently to become skilled. The operator will then have added to his operative procedure one of the most valued methods of restoring lost tooth tissue.

Dr. Argue (closing): Dr. Vehe mentions irregular treatment. Those teeth that are out of line in the arch should not be considered in our line of work, for the reason that we have the pulp and many other problems to consider and how much better results could be obtained scientifically by referring cases, the young cases particularly, for orthodontic treatment. As to the beveling of the cavosurface angle of the shoulder, we are making these preparations on the teeth of people of all ages. In older persons when the gum tissue has normally receded and the shoulder is ex-

tended nearly to the cemento-enamel junction, the rods are short, and when we make an impression of the prepared tooth, these short rods are liable to chip and fall out. Therefore, it would be best to give this cavosurface angle just a slight bevel to overcome this. But in young people, say about 20 years of age, when we have a good broad surface of enamel, I agree with Dr. Vehe that it would not be necessary to bevel the cavosurface angle of the shoulder at all. The variations in color at the labio-incisal third is another good point. I think Dr. Vehe answers this himself in stating that the enamel should all be removed to the shoulder. That is one of the first principles that I stress in teaching students. When this is carefully followed out, the uniform thickness of porcelain body can be built in making the normal contour in our tooth form, also giving the normal variation of color desired and a thickness of porcelain to stand the stress of occlusion. We should not do anything in any line of operative dentistry without the use of the roentgen ray. It is a great help, and one thing we should stress very strongly is that our patients should have not single but full mouth roentgenograms so that we can check up on every kind of condition that may possibly be found in that mouth. Dr. McBean spoke of rotated teeth. Many nice corrections can be made in a modified preparation on teeth that are slightly rotated. This can be done so that the tooth can be built to correct this rotation, giving a corrected alinement to compare with the alinement of the other teeth. Along that same line, say, for instance, if we were making a full correction of the upper or lower denture in the mouth, we have places where there is missing a cuspid and we have a bicuspid in the position of the cuspid. We can often make a cuspid out of that first bicuspid and add to the harmony of the arrangement of the teeth very markedly. As regards the shoulder formed by stones, that is a little different than the technic we all have become familiar with. However, I think that point is well taken. I have no objections whatever to men using stones provided they cause no irritation to the gum tissue. This is the principal danger. We can use stones and form the shoulder nicely. That is the business of the operator, but he must use much more care in operating with the stone than with the bur. If we have the enamel all removed to the gingival margin as I stated, we have no difficulty in doing it more quickly and more definitely with the bur. Today, we are arriving at a more standardized method of technic in the preparation for porcelain jacket crowns.

NATURAL EFFECTS IN PORCELAIN*

By E. L. PILKINGTON, D.D.S., Detroit, Mich.

PROBABLY, no restorations in dentistry are comparable to porcelain restorations from the standpoint of beauty and esthetics. Possibly, no subject could be more interesting to the dental ceramist who is continually striving to improve the quality of his services than a discussion of some ways of making his results more lifelike.

Until recently, porcelain work, and more particularly jacket crown work, was considered to be perfectly satisfactory if the ordinary requirements as to fit and approximate color were met. This might be considered true even now in 50 per cent of our cases. The more discriminating patients are not satisfied with ordinary results and are going from office to office seeking work that is more pleas-

*Read before the Section on Operative Dentistry, Materia Medica and Therapeutics at the Seventy-First Annual Session of the American Dental Association, Washington, D. C., Oct. 9, 1929.

ing and natural. It is these particular patients who make it possible for the exacting dental ceramist to use to the fullest extent his knowledge of art and esthetics in porcelain work.

The tendency of the average porcelain worker is to delegate to others much of the operative procedure in porcelain restorations. This has deprived him of the distinct stamp of individuality in his finished operations.

While it is true that often the ability of the technician to make a crown mechanically is superior to that of the operator, the finished product does not bear the close anatomic harmony to the adjacent teeth that is so necessary in this type of work. All to often, we find the technician making ovoid type crowns to be placed in a distinctly tapering mouth. We also find, after further observation of this man's work, that he makes approximately the same type tooth for every case. It follows that either the operator must train himself in the operative procedure of porcelain manipulation or that he must get into much closer contact with the technician, so that more of the anatomic features that are required will be instituted in the finished product.

Porcelain work has not been generally accepted by the dental profession because of the supposed difficulty of manipulation and the uncertainty as to results. This is due to a misunderstanding on the part of many of our operators, who, if they would spend even a little time in learning one of the modern technics in porcelain manipulation, would find that the reward for their efforts would far exceed their expectations. This condition is especially true regarding the use of stains to obtain superior effects in our finished operations.

It is here that a dental ceramist can, with aid of a diligent study of the essentials, make himself capable of producing results of the highest merit. To some, the road may seem to be long and full of pitfalls, but the results achieved after the difficulties have been surmounted are more than adequate to repay them for their efforts.

There are various ways of producing natural effects in nearly all types of dental restorations, from jacket crowns to bridge facings and even full dentures. We have to accept from the manufacturers teeth which are not entirely fit for our needs. We find no signs of age or wear in these teeth but are compelled to use them, in spite of the fact that nearly every patient who needs an artificial substitute of this nature is at a period of life when use has left its mark on the teeth. It is only through attention to minute details that one of these teeth can be carved and stained to represent more closely the eroded landmarks left by nature. When bridges or crowns are constructed that are next to teeth having characteristic markings, we have absolutely failed in our restoration unless we accurately reproduce those stained areas correctly.

Even though the tooth has been perfectly carved, we have not reached perfection unless those little defects that are peculiar to those teeth are exactly copied.

Teeth should be studied; their shapes, peculiar markings, color and type. It is astonishing how much can be learned by merely observing closely the remaining teeth when a crown or bridge is under consideration. At times, it is surprising to find how little work is required to change a stock tooth into one which will harmonize exactly with its surroundings. It is not necessary always to stain teeth to enhance their naturalness. Frequently, reshaping and grinding in the labial and incisal characteristics is all that is neces-

sary for an exact duplication. Perhaps the first requisite in obtaining natural effects is the exact anatomic copy of the adjacent teeth. It is even conceivable that a more sightly result might be obtained by exactly sculpturing a tooth without stain than that which is obtained by the most accurate staining on a poorly sculptured tooth.

The need for a large collection of natural teeth cannot be emphasized too strongly. It is really surprising what a liberal education one can get by studying the different densities of color and the various shadings.

This is especially noted when full mouth extractions are mounted in plaster casts. Here, one can see the difference in amounts of stain in various localities in the same mouth.

The question most often asked in this work of obtaining natural effects in porcelain is: How do you go about it, and what is your first step after you get the proper materials?

It might be said that tooth anatomy and color sense constitute the barrier between the porcelain beginner and success, and not the mechanics of manipulation as is commonly supposed. All dentists have had instruction in tooth anatomy in college, but color sense is a different matter. The exact appreciation of color is a matter of study and observation and the careful education of the eye to the point where it can detect and be able to distinguish definitely the various tints and hues met with. A beginner should study the colors in teeth, bearing in mind that, with few exceptions, he is studying one or more translucent layers of color superimposed one over the other so that the resulting shade is a combination of colors. This fact that the layers of color are translucent or, in some cases, almost transparent makes the tooth seem of a totally different shade from its real color. This illustrates the necessity for each individual to study and train his eye, for there is no rule or formula that will educate his eye for him. So, an answer to that question might be really to look at the tooth in question with the idea of observing all there is to see. These observations should take a definite form.

METHOD OF PROCEDURE

For the sake of simplicity and an illustration as to how to obtain natural effects, I shall take an ordinary tooth, avoiding as much as possible all technicalities in operative procedure. For instance, suppose the tooth in question is a jacket crown for an upper central incisor in a man 45 years of age. The first thing to do is to sketch the outline of the tooth on a piece of paper. This will denote the type and also the amount of incisal wear. No attempt is made in this drawing to record surface markings or tooth structure beyond the bare outline of the tooth.

CHARTING SURFACE STAINS

In charting surface stains, it is necessary to inspect the tooth closely to determine whether they are superficial stains, which can be polished off, or actual surface discolorations. All teeth should be polished to remove this superficial débris before any attempt is made to chart the surface stains. After this is done, we may find cervical or interproximal stains, which are usually some shade of brown. There may be a slight yellow or brownish cast to the labial surface, which usually gets deeper in shade as it blends with the darker cervical colors.

Of course, there are other colors or combinations of colors that are found in teeth, but, as mentioned before, as we are shading a specific tooth to illustrate a method of procedure, we will confine our colors to those most commonly met with.

In a patient of this age, we usually find some checking of the enamel. These checks are manifested by stained lines extending from the incisal edge toward the cervical. The color of these checks is usually some shade of brown, but they may vary from red to bluish black or even black.

Both the surface stains and the checks should be carefully shaded or drawn in the sketch, with a note of the color.

CHARTING SUBSURFACE STAINS

Our next consideration is the colored areas underneath the surface. These vary from those white decalcified looking spots to yellow and brown areas which are not so definitely outlined as the white spots. Sometimes, it is wise to make a note of these subsurface stains on a separate drawing so as not to confuse them with the surface stains. Drawings of the tooth in this manner may seem a great deal of work, but in reality take but a moment or two and are invaluable for use when the patient is not there for direct reference.

SELECTION OF COLORS

The next question, now that the drawing has been made and the colors noted is: How can all these shadings, lines and colors be faithfully reproduced in the jacket crown? In answer to this, it is necessary to revert back to the subject of color. Unfortunately, it is true that the stains on the market which are available for this work are supplied in only a few of the major colors.

These colors are rarely met with in actual use. Also, most of the colors are far too brilliant and need subduing to make them of practical value. It is nearly always necessary to mix two or more shades to get just the right color for a perfect match. Owing to the difference in color strength or pigmentary values of these various major shades, it is next to impossible to tell how much of one to mix with another to arrive at a given color. It would seem that fifty parts of one color mixed with fifty parts of another would give a shade half way between the two, but, unfortunately, it does not: it is always nearer to one than the other. So, until the manufacturers supply us with a wider assortment of colors, it will be necessary for us to broaden the range of colors ourselves. This can be done by dividing each shade into several parts which can be mixed with the other shades in varying proportions, so that a large number of colors result. Mixing of the various batches may be facilitated by grinding with a mortar and pestle. This will not only mix the colors thoroughly but will also grind the stains much finer, making them easier to manipulate, especially where a thin spread is desired.

After this is done, it is of the utmost importance to fuse a sample from each batch on a tooth. This is the actual shade for each batch and will always be constant in color. These teeth can be used as shade guides and taken directly to the mouth for the exact shading of those tricky and troublesome colors that have proved so hard to match before.

Recently, I divided samples of yellow and brown stains into eleven different colors. After they were fused on teeth for reference, the result was a graduation of brown shades that fitted exactly the shades most commonly met with.

The most disheartening part of this work is the color problem, chiefly because of the uncertainty of obtaining just the right hue or shade. That can be changed to a great satisfaction by compounding twenty-five or thirty, or even more, colors in the manner just described.

With this number to choose from, we can approach the problem of color selection in the mouth with every confidence that the tooth can be matched exactly without resorting to endless mixing of colors in an attempt to accomplish this.

BUILDING THE CROWN

We will assume that the crown has a brown area just under the enamel which clearly shows through. The color seems to be fairly dense in the center of this area and thins out gradually toward the borders of the tooth. As our inspection has shown that this stain is just under the enamel and not in the dentin, it follows that the body or dentin part of the crown can be built up at this time, merely by the use of the proper shade of porcelain, and fired to a medium biscuit. Now, referring to our drawing, and using the exact shade of high fusing brown stain, we mix the stain with glycerin to a thin paste and paint on the crown a duplicate of the stained area in the drawing. We fix this on by a mild firing, build on the right shade of enamel body and bring to a high biscuit.

DENTAL ANATOMY

At this time, as mentioned before, we have the very important subject of dental anatomy to deal with. I find that there are few operators who can build a crown and supply all the anatomic features necessary for a finished restoration in the crown with a brush or carver before firing.

It is my experience that most operators are able to copy more nearly the anatomic features of the adjacent teeth with fine well-chosen stones than by any other method.

During the grinding and shaping process, it is impossible to exercise too much care in studying and copying both surface and type structure. The tooth can be divided into different sections for convenience or can be studied as a whole. The grinding should be done at the chair, the operator utilizing magnifying spectacles as aids. The lingual structure should also be faithfully copied as well as the other surfaces. After all the surface detail has been ground as nearly as possible, the crown is placed in the furnace and glazed. It will be noted that glazing brings out the naturalness of the subsurface staining to its fullest extent, and finishes the crown as far as size and anatomy are concerned.

APPLYING SURFACE STAINS

Now, the crown is ready for the surface stains, which, incidentally, have to be of a lower fusing point than the porcelain in the crown. It is best to use medium or low fusing stains for surface stains, thereby minimizing the danger of blistering or overfusing the crown by too many fusings at high temperatures.

The drawing shows that the crown should have some cervical stains and also interproximal stains of two shades of brown. We have shaded them up with our color guides and know that our match will be perfect. The shades are mixed with glycerin to a creamy consistency and applied exactly as shown in the drawing, with a fine sable hair brush.

ENAMEL CHECKS

Next, we examine our enamel check lines and match them perfectly as to color. These can be drawn on the surface as they are in the sketch, with a draughtsman's drawing pen.

The mix of stain should be creamy and can be used like ink, as fine or as wide a check line being made as is desired.

These lines can also be traced on with a sharp lancet as a pen, or can be rubbed into a fine scratch made with a diamond graver. The crown is then fired to the

fusing point of the stains. The crown has now been built and carved anatomically; has been stained with both subsurface and surface stains according to the chart, and is ready for finishing.

FINISHING

It might be said there are three major premises in the construction of a crown such as this: color, structure and finish. A study of the surface texture of natural teeth will quickly convince one that not all teeth have a glassy, glistening surface such as a highly glazed porcelain crown possesses. It often seems that the glazed crown would look more natural if it were polished rather than glazed.

The raw glazed surface seems to lack somehow that polished, satiny finish that so many teeth have.

As a rule, stains do not appear on or in teeth until age and use have exacted their toll. Therefore, these teeth have had many years of smoothing and polishing from tooth brushing as well as from the excursion of food over their surfaces. Any restoration that does not match in surface texture as well as color most certainly is a failure from an esthetic standpoint at least. A study of the neighboring teeth in the patient's mouth will demonstrate that the teeth are highly polished, with a surface which looks as if it had been given a high finish on a buff wheel. Naturally, surfaces having the highest polish will be the localities most accessible to food and the toothbrush. We find that the tooth becomes more highly polished as the incisal edge is approached; also, that the bottoms of the surface irregularities are not so highly polished and seem to be more stained.

Now, if a sandpaper disk were used and the surface throughly disked until the stains were removed from the prominences, we should create the same conditions that Nature has arrived at; that is, polishing the high spots. Of course, the disk cannot get down into the cracks and fissures, and the stain is left there exactly as it is left in nature. This is the procedure which seems to produce the best results. After this has been done, the crown can be polished with tin oxid and a felt wheel. The secret of doing this successfully, if there is one, is to wet the wheel with water before using it and to use plenty of tin oxid. The resulting polish can be made to duplicate the surface texture of the other teeth, and will be the final step necessary for a perfectly matched and shaded crown.

Afterwards, the surfaces are cleaned and washed with a spray bottle.

It must be remembered that there have been no deep cuts, nor has the surface of the crown been ground through in any place. This is distinctly a surface polish, all cutting having been done at the time the anatomic features were ground in.

I recommend sand disks for obtaining a surface finish because it is hard to cut too much with them. Every operator has them and is familiar with their use. Black disks must not be used on any kind on porcelain if clear unspecked work is desired.

SETTING THE CROWN

As far as the setting of the crown is concerned, the usual precautions are all that are necessary. If in doubt as to the shade of cement, it is best to mix some of the powder with water and try on the crown, with this as cement. This will show the shade and can be washed out and another trial made if necessary.

This finishes and sets the crown, and should, if each step has been executed faithfully, produce a crown which cannot be equaled in the field of dental ceramics. Its beauty and naturalness are

such that the operator, who has had the patience to learn the technic, gets unbounded satisfaction from his results. It has been truly said that the dental ceramist is the premier exponent of the art of hiding art rather than exhibiting it.

CONCLUSION

I should like to make a plea for more interest in the work of copying Nature's defects. I truly believe that, with a little patience and a small equipment, the exacting operator can soon perfect himself in this work, when his results will many times repay him for his trials and hours of study.

General Motors Building.

DISCUSSION

Edward E. Haverstick, St. Louis, Mo.: I wish to recommend this work to you and encourage more to take it up. It affords real pleasure to the dentist. Patients are delighted with it. Every one who does this class of work has felt the need of a greater variety of shades and no doubt these will be forthcoming from the manufacturers in the near future. Dr. Pilkington has explained how these shades may be produced by the dentist, but it would be a great aid if they were prepared by the manufacturers. If the mineral stains alone are applied thin enough to give the faint hues desired, they may be worn away in time by mastication and by brushing. When a porcelain powder of a lower fusing point than that used in making the body of a tooth to be stained is mixed, as Dr. Pilkington has said, with the stain a more delicate hue can be produced and it will not wear away.

THE MAXILLARY SINUS*

By HOWARD C. MILLER, D.D.S., F.A.C.D., Chicago, Ill.

A REVIEW of much of the literature of the past several years pertaining to the paranasal sinuses reveals many articles describing the various diseases of the maxillary sinus, their origin and treatment. It is interesting to note that, a few years ago, the articles prepared by the rhinologist described the various types of nasal operations in the treatment of the maxillary sinus, and stated that the greatest percentage of infections came from the nasal passages and other accessory sinuses. The articles prepared by the oral surgeon and dentist dealt with the operations for the relief of maxillary sinus infections that are so commonly known to the dental profession, such as opening into the sinus through a tooth socket after extraction, or through the cuspid fossa, and by the insertion of various types of tubes, drains and appliances through these openings for drainage and irrigation.

Another interesting fact was that many of these writers associated the origin of such infections with the teeth in the greater percentage of cases; there appearing to be no attempt at cooperation between the two specialties.

The literature of the last few years shows a decided change toward advocating the cooperation of the rhinologist, oral surgeon or dentist in the treatment of the maxillary sinus. This apparently

*Read before the Section on Oral Surgery, Exodontia and Anesthesia at the Seventy-First Annual Session of the American Dental Association, Washington, D. C., Oct. 10, 1929.

has been more evidently true in the field of the oral surgeon and dentist than in that of the rhinologist, possibly owing to the fact that it is only within the past few years that any particular thought has been given to the possible relationship between infected teeth and subsequent remote disease of the body, and the possibility that infected teeth, especially the upper bicuspids and molars, may cause an infection of the maxillary sinus or obstruct successful nasal treatment when ignored.

In the preparation of this paper, an attempt has been made to confine all remarks to the practical phases of the various conditions that are met with, which necessarily must be cared for by the oral surgeon and exodontist, and, in many localities, by the dentist in general practice.

Authorities differ as to the origin of maxillary sinus disease, and various percentages are quoted as to the number of cases arising from either nasal or dental infection. It is unnecessary to determine the exact percentage; for it remains a fact that maxillary sinus infection results from both sources, and, in many cases, the cause, being obscure, is difficult to determine.

The interest of the dental profession in disease of the paranasal sinuses is well summed up in a recent statement by Dr. Hubeny of Chicago: "It is most natural that the dental profession should be concerned with diseases of the nasal accessory sinuses, because we all know the disease might involve neighboring or remotely situated organs by a hematogenous or lymphogenous route or by continuity or contiguity of tissues."

It is fortunate that the point of view of the rhinologist is to be presented here in the discussion of this paper by LeRoy Thompson, whose investigation and treatment of the paranasal sinuses have placed him in a position to express as an authority the importance of close cooperation between the two specialties.

The successful treatment of all infections of the maxillary sinus is based upon an accurate diagnosis, which can best be arrived at after a thorough knowledge of the anatomic structure has been obtained, and after a careful study of the relation of the maxillary sinus to the other paranasal sinuses.

It must be remembered that the maxillary sinus is an accessory sinus to the nose, which normally contains air, and varies greatly in form and size in different individuals and often in the same individual. Boyne,[1] in his "Study of Forty-Three Maxillary Sinuses," points out that the most common differences found were those in form, size and communication, and his published article giving in detail these variations, with the anatomic findings, is a valuable contribution to the study of the paranasal sinuses.

The mucous membrane lining the maxillary sinus is continuous with that covering the bones and cartilage of the nose, and for this reason, is susceptible to the same diseases as are found in the nasal passages. The lining membrane of the maxillary sinus consists of a ciliated columnar epithelium in which are located many mucous glands, loose connective tissues and lymphoid cells. These special tissues, under normal conditions, afford self-drainage of the sinus through the ostium maxillaire into the middle meatus of the nose. Therefore, any operative procedure designed for the treatment of maxillary sinus infection must be carried out with the greatest respect for this highly specialized membrane and with

1. Boyne, H. N.: Study of Forty-Three Maxillary Sinuses, J. A. D. A., 13:574 (May) 1926.

every effort to prevent extensive destruction or undue traumatism.

A true diagnosis of maxillary sinus disease can be made only by the correlation and consideration of the past history, history of the present condition, clinical findings, roentgenographic findings—determined not only by the anteroposterior and lateral sinus views, but also by a complete set of intra-oral dental films, which should include all edentulous areas as well as the remaining teeth—vitality tests, transillumination and any other diagnostic means that may aid in obtaining a true knowledge of the conditions presented. In the majority of cases, the cooperation of the rhinologist is imperative in order that his opinion and interpretation of the conditions found in the other paranasal sinuses and nasal passages may be combined with the findings of the oral surgeon, and from this complete consideration of all factors will the patient receive the greatest benefit.

Particular mention should be made of the roentgen ray in the diagnosis of maxillary sinus infection, not only on account of its inestimable value in arriving at a clear diagnosis, but also because of the fact that, in many cases, too much emphasis has been placed on its findings, without further substantiating evidence such as it is, or should be, possible to obtain.

The diagnosis shown by the roentgenogram cannot be accepted as final; but as roentgenography advances, it is becoming increasingly valuable as an adjunct in diagnosis. The perfection of the technic of making and reading stereoscopic roentgenograms has been most beneficial, especially as far as anteroposterior views are concerned. The use of lipoidal, which is injected into the sinus either through the normal opening, nasal wall or cuspid fossa before exposure to the roentgen rays, has made it possible to diagnose more definitely the alterations in the mucosa, thickening of the membrane, cysts and polyp formations, all of which may play a part in completing the diagnosis.

R. Boyd Bogle[2] reports the successful use of lipoidal in the diagnosis of several difficult cases. C. E. Cook, of Chicago, has offered much valuable information in diagnosing many difficult maxillary sinus infections, by the making and reading of the steroscopic roentgenograms and by the use of lipoidal in many of the cases before exposure to the rays.

Clinical and roentgenographic examination of all teeth and edentulous areas is imperative to the treatment of every maxillary sinus infection, whether it be treated exclusively by the rhinologist or by the oral surgeon. Many cases are continuously treated through a naso-antral opening, if infection persists in the floor of the sinus from the presence of infected teeth.

The use of transillumination as an aid to diagnosis of maxillary sinus infection has its limitations, and no operative procedure should be carried out without further substantiating evidence from the other means at the command of the diagnostician. Great claims have been made for transillumination in advertising literature of concerns manufacturing various types of lamps, to the effect that practically any type of oral infection may be discovered by this means. In the maxillary sinus, it is a valuable aid when an equal translucency is obtained through both sinuses of the same patient, indicating a normal condition, or where one sinus shows dark by relative comparison with the other, an infected condition be-

2. Bogle, R. B.: Aid in the Diagnosis of Maxillary Sinus Conditions, J. A. D. A., 16:1289 (July) 1929.

ing indicated on the dark side. It may be misleading, owing to variations in the size of the sinus and the density and thickness of antral walls, which can materially affect the penetration of the rays. Its value is in its simplicity and the ease with which it can be used as one of the aids in diagnosis, provided its limitations are kept fully in mind.

Clinical symptoms such as pain, swelling and tenderness over the affected side, soreness of the teeth in the maxillary region on occlusion, headache, ocular disturbances, especially on leaning forward, postnasal dripping, disagreeable nasal discharge which is more noticeable on arising, the presence of pus in the middle meatus and other disturbances of the nasal passages that may be seen by the rhinologist must be taken into consideration along with all other findings.

It is to be regretted that all these considerations do not always result in a complete diagnosis, and it is necessary to resort to direct inspection, either by puncture of the naso-antral, or bucco-antral wall, enlarging the opening sufficiently to allow examination of the sinus. It is preferable to make such an opening through the bucco-antral wall, just posteriorly from the cuspid and above the bicuspid teeth. The opening may be enlarged to afford necessary access, and is easily closed by the flap of mucoperiosteum, which should be reflected before an opening is attempted through the osseous structure. Puncture of the naso-antral wall and irrigation is one of the methods used when doubt exists regarding the possibility of an infection, the examination of the washings revealing the presence or absence of secretions.

The etiologic factors in the various types of maxillary sinus infections which are met and necessarily must be cared for by the oral surgeon, exodontist and dentist are those arising from dental conditions. The following are the usual sources of infection:

1. Extension of periapical or pericemental infection about the root end of the teeth into the floor of the sinus.

2. Extension of infection into the sinus through the improper removal of teeth which show periapical involvement near the floor of the sinus.

3. Traumatic injury in the floor of the sinus, resulting in its penetration on the removal of teeth, such as the rocking movement of extraction, which tears into the sinus at the point immediately above and in contact with the root, as described by Lyons.[3]

4. Extension of infection into the sinus through improper postoperative care of tooth sockets following removal of teeth, such as allowing an opening in the floor to remain from continued packing and irrigation.

5. Forcing of root tips into the sinus during extraction.

6. Involvement of the sinus through the presence of impacted or supernumerary teeth, cysts and tumors, malignancy, fracture of the maxillae and osteomyelitis.

The principles which underlie the proper treatment of maxillary sinus infections are, for the most part, quite the same, whether the infection is of dental or of nasal origin. The outstanding principle in any treatment should be the establishing of proper drainage and ventilation of the sinus, with removal, as far as possible, of the causative factors.

The treatment and operative procedure that is best suited to maxillary sinus disease resulting from extension of periapical infection into the sinus, in which chronic inflammation has been set up,

3. Lyons, H. R.: Empyemia of the Antrum of Highmore Secondary to Extraction of Teeth, J. A. M. A., 78:486 (Feb. 18) 1922.

with resultant production of mucus and pus, as well as swelling and polypoid degeneration of the mucous membrane, is that which is carried out in cooperation with the rhinologist. After a complete diagnosis has been made, the area is blocked, by the method of blocking the second division of the fifth cranial nerve, as described by Smith,[4] in conjunction with the topical application of procain to the nasal tissues.

After anesthesia has become complete, the operative procedure should follow that presented by Shearer,[5] in which a flap of mucoperiostium sufficiently large to assure proper access for the elimination of the teeth and periapical infection and for the opening of the maxillary sinus is reflected back. Sufficient process is then removed from the buccal surface to allow delivery of the teeth without extensive trauma, and to afford direct vision for the removal of the periapical infection. After careful elimination of these dental conditions, an opening is made through the floor of the sinus, sufficiently large to afford direct vision of the sinus walls. Through this opening, the mucus, pus and areas of polypoid degeneration are carefully cleaned out by the use of small gauze sponges or strips. This is done with the utmost caution to avoid excessive trauma to the lining membrane. Extensive or vigorous curettement should be avoided, and curettement of any type should be resorted to only when it becomes necessary to remove a firmly attached polyp or necrotic area; keeping in mind always the necessity for the protection, as far as possible, of the ciliated epithelium lining of the sinus.

When the sinus has been thoroughly cleaned and before closure of the mucoperiosteal flap, the rhinologist makes an opening through the naso-antral wall beneath the inferior turbinate, which is in no way disturbed except for a slight elevation in order to gain access. This opening should be sufficiently large to allow proper ventilation, drainage and irrigation as frequently as may be necessary.

The rough, ragged edges of bone which are left after naso-antral puncture should be smoothed from the buccal opening, and all remaining bone particles carefully cleaned out before closure of the flap. When excessive bleeding or hemorrhage is anticipated, a loose dressing of iodoform gauze strip covered lightly with sterile olive oil or vaselin (petrolatum), may be inserted, the end being allowed to pass through the naso-antral opening into the nasal cavity, and removed through this opening after forty-eight hours. It is usually unnecessary to insert any further dressings. The flap is then sutured back into position with complete closure within the mouth, all further treatment being conducted through the nose except for the usual postoperative care necessary in surgical procedures within the mouth.

The acute infection resulting from extension of periapical infection into the maxillary sinus without the formation of polyps usually responds quickly to treatment after the removal of the causative dental infection, with sufficient irrigation through an opening in the floor to afford a clean field without extensive surgical interference or nasal puncture. An opening of this type should be small, and should not be allowed to remain open over a long period. If the sinus does not

4. Smith, A. E.: Block Anesthesia and Allied Subjects, St. Louis: C. V. Mosby Co., 1920, p. 380.

5. Shearer, W. L.: Focal Infection of Dental Origin and Principles Governing Its Removal, Nebraska M. J., 8:225 (July) 1923.

respond to treatment within a reasonable length of time, the cooperation of a competent rhinologist should be sought, as continued irrigation through the mouth may result in a chronic maxillary sinus infection.

The extension of infection into the sinus, due to the removal of teeth, can usually be avoided by a careful technic in the removal of infected teeth, especially the upper bicuspids and molars. A skilful technic in the removal of teeth of this type is far better than the most carefully designed maxillary sinus operation, which may be necessary should such technic be ignored.

Closure of openings into the sinus after the removal of teeth should be made by reflecting a mucoperiosteal flap from the palate, as described by Howard.[6] All broken root tips which are accidently forced into the sinus at the time of extraction should be removed immediately, the same skilful surgical procedure being followed as is necessary in any successful operation within the mouth.

The same skill and painstaking care in the removal of impacted or supernumerary teeth, cysts and tumors and the treatment of osteomyelitis and fracture of the maxillae which are near the maxillary sinus is necessary to prevent involvement of the sinus by an infectious process, which may necessitate a long period of treatment.

The early recognition of malignancy in maxillary sinus disease is imperative, for if a correct diagnosis is made in the early stages of such involvement, it will yield to treatment here as in any other part of the body.

An attempt has been made to present the manifestations and treatment of maxillary sinus infection of dental origin, for it is certain that infection of the maxillary sinus, whatever the original cause, is undoubtedly more common than formerly was recognized. The use of a complete set of intra-oral films, in oral diagnosis, has brought to light many maxillary sinus infections which were never known to exist, because of the lack of the usual clinical symptoms.

With the discussion of Dr. Thompson, who is to present the rhinologic point of view in the discussion of this paper, this presentation should be considered a symposium covering the subject, of which my paper represents but one part, rather than as a presentation and discussion as listed in the official program.

55 East Washington Street.

6. Howard, M. R.: Intra-Oral Radical Antrum Operation, J. A. D. A., 12:28 (Jan.) 1925.

DISCUSSION

Le Roy Thompson, Chicago, Ill.: The physician is rapidly learning to consider dentistry and its allied specialties as a most important branch of medicine and surgery. Any general physical examination which does not include a consultation with a dentist regarding the condition of a patient's mouth is incomplete and, from the rhinologist's viewpoint, not worthy of the name. Parasinus diseases, in the majority of cases, begin in the maxillary sinus. It has been my experience and observation that ethmoid, frontal and sphenoid infections are rarely found without involvement of the maxillary antrum of Highmore, and frequently these infections have been preceded by such an involvement. It is not a difficult matter to diagnose maxillary sinus disease and determine definitely its relationship to rhinologic or oral disease or a combination of both. If we accept this premise, it becomes obligatory to seek the assistance of an oral surgeon or dentist in every case of maxillary sinus infection. Many rhinologists have taken the definite stand that if a pathologic condition is found in the nasal mucosa with evident infection of the antrum, the disease is of nasal origin, and they treat it as such. On the other hand, many oral surgeons have considered that if evidence of oral disease is found in the presence of maxillary sinus disease, the oral infection is the

etiologic factor, and, therefore, the case should be treated by an oral surgeon. It is my belief that both are in error. We find so many cases in which a patient does not recover under this isolated treatment. Whereas, when both points of view were taken into consideration and treatment was instituted by an oral surgeon and a rhinologist, the patient has made rapid and satisfactory recovery. It has been my pleasure to operate in combination with the oral surgeon on a great many patients. The end-results have been most satisfactory and gratifying. In my early years of practice, I did this work alone and, I am forced to admit, my end-results lacked the encouragement afforded by the present method. I do not believe that any one particular type of operation is satisfactory in all cases. The technic employed must be suited to the condition found in the individual sinus. Our procedure in diagnosis of suspected sinus diseases is as follows: Examination of the nose, including the nasal mucosa, and observation of septal or turbinate malformations which partially occlude or interfere with normal breathing space; a vertification of the examination made by means of the Holmes nasopharyngoscope; posterior nasal rhinoscopy; cultures of pus and secretions; stereosinus roentgen-ray pictures, which may be supplemented by lipoidol injection of the sinuses. To complete this information, the patient is referred to a dentist or an oral surgeon for roentgenograms of the teeth, and the dentist's interpretation of conditions is found therein. In every case which does not clear up under simple lavage either through the ostium maxillaire or by trocar puncture into the sinus through the inferior or middle meatus, a diagnostic puncture should be made in the region of the canine fossa with the antra-scope. I cannot but comment on the fact that we, as physicians, are confused by the various interpretations given by our dental friends on roentgen-ray findings. I will not advise or suggest a remedy for this frequently unsatisfactory state of affairs. I think the matter should rest entirely with the oral surgeon and the dentist. It is not and should not be a part of the otorhinolaryngologist's diagnosis. In making an opening or Krause window into the maxillary sinus through the inferior meatus, great care should be exercised not to disturb the function of the inferior turbinates. In rare cases, it is necessary to remove the anterior fourth of the turbinal body, but usually simply lifting it away from the antral wall by means of a long-nosed nasal speculum will give ample room for the necessary surgery. Leaving the turbinate intact forms a protective covering over the ventilating window and the air is warmed and filtered before passing into the antrum on inspiration. It is my opinion that some of the annoying symptoms complained of by patients who have been operated on without this protective measure are due to cold air striking the sensitive mucous lining in the antrum. The tight closure of the buccal flap is an important point, as oral bacteria are not conducive to rapid healing when they invade the maxillary sinus. I would emphasize the fact that all postoperative treatment, such as lavage and instillation of various medicaments, should be made through the opening in the naso-antral wall. What Dr. Miller has stated about transillumination, I should like very much to stress. I have found it unreliable except where definite new growth is present. While it should never be neglected, it should be considered merely as an adjunct to diagnosis. As an aid in diagnosis, the stereoroentgenograms developed by Eugene Cook of Chicago have proved more satisfactory to me than any other. Percentages, while interesting, are not always accurate, and we cannot be governed completely by such tabulations as given by the following authorities: J. A. Glassburg[7] reports three cases in which sound teeth were infected from acute suppurative maxillary sinusitis. The diagnosis was confirmed by the dentist, the roentgenologist and the rhinologist. Mithoefer[8] reports forty-eight radical cases, with no oral etiologic factors. H. R. Lyons[3] reports 100 cases in which the duration of infections with fistulas was 349, the shortest being three days and the longest ten years. The average time of treatment through the fistula tract was 170 days. Most cases were cleared up by a modified Krause window in the inferior meatus. One serious complication encountered in maxillary sinus diseases is otitis media, which is followed in many instances by mastoid infections. Many

7. Glassburg, J. A.: Dental Infection Secondary to Acute Maxillary Sinusitis, J. A. M. A., 78:883 (March 25) 1922.

8. Mithofer, W.: Hyperplastic Maxillary Sinusitis Nonsuppurative, Cincinnati J. Med., February, 1928.

patients would escape this serious malady if an early diagnosis of antrum disease was made and proper treatment instituted. This holds good with children as well as adults. There is no doubt that we physicians are to blame for a part of the lack of cooperation between the dentist and the otorhinolaryngologist, but a certain measure of the responsibility may also be laid to the apathy of the dental profession as related to our specialty. In twenty years of practice, it has been my privilege to refer a great many patients to dentists or oral surgeons for consultation. Up to the present time, my records show that less than 2 per cent have sent me written reports relative to their diagnosis and treatment. Should we send a patient to a laboratory for a roentgen-ray examination, a blood Wassermann test, blood count, urinalysis, or any other of the innnumerable diagnostic aids, and not receive a written statement relative to the findings, one can well imagine the unsatisfactory results which would ensue. Yet oral diagnosis is of equal importance with any of these diagnostic aids that I have enumerated. The importance of cooperation between the two specialties based on intelligent diagnosis by both the dentist and the otorhinolaryngologist cannot be too emphatically stressed. In a case of squamous-cell carcinoma of the antrum, the patient gave a history of pain over the antrum for several years, for which she sought relief from her dentist. When she finally consulted a rhinologist, it was too late, and death ensued a few months later. Had the dentist referred his case to a rhinologist when he found that the pain persisted after the teeth had been cared for, her life might at least have been prolonged. We are all working for the elimination and relief of sinus diseases. None of us can afford to overlook the assistance made available by a practitioner of another specialty. Dentistry is a highly specialized branch of medicine and should be so considered and used, to the greater benefit of all concerned.

A. T. Rasmussen, La Crosse, Wis.: I wish to emphasize a little further, if possible, the importance of careful observation in diagnosing the chronic case. The acute case is not usually difficult to diagnose, but some chronic cases I have found exceedingly difficult, and I admit that it has taken a long time and the most careful observation to make a definite diagnosis. The symptoms are not always what we expect. The subjective symptoms may be very distant from the diseased sinus itself, and this makes it very difficult, at times, to connect some symptom with a disturbance of the sinus. Only an intimate knowledge of the anatomic structures associated with the sinus will lead to a correct diagnosis in such cases. Errors in diagnosis may arise from placing too much dependence on transillumination or roentgenograms in cases of double sinusitis or a pansinusitis. In such cases, transillumination or the roentgenograms will probably not show much difference in the translucency or radiolucency, if you please, of the two sinuses. Valuable as these means are in some cases, they do not always reveal the true conditions that exist. Again, I have seen a few cases in which the only apparent lesion that could be found after opening the sinus involved the mucoperiosteum lining the antrum, which was almost completely destroyed. Neither transillumination or the roentgen-ray will reveal such a condition; at least I have never been successful in using them for that purpose. Therefore, we should be very careful in deciding that there is not a diseased condition of the sinus or sinuses just because the translucency is the same or is apparently normal. Normal mucoperiosteum does not obstruct the passage of the rays to any marked extent, and consequently the difference in translucency, when such a membrane is missing, will be very slight indeed. In those obscure cases in which we cannot quite make up our minds as to what the trouble is, we should study the case long and carefully, and we may find that some distant symptom will lead us back to a diseased sinus. At least, that has been my experience. As to treatment, there is no use, in fact, it is the height of folly, to treat the maxillary sinus and expect to get results if there is an involvement of the ethmoid or frontal sinuses with the discharge draining into the maxillary sinus, and that occurs much more frequently than is generally recognized.

Dr. Miller (closing): I wish to call attention to the statement made by Dr. Thompson that only 2 per cent of dentists to whom he has referred patients for service have sent him a written report of their findings and recommendations for treatment. This is rather an unfortunate condition, but we all know that many dentists have been negligent in this important and necessary

duty to the medical profession. When such a report is made, it is well not to rely on the roentgenogram alone, or arrive at a decision after reading the films. The patient should be carefully examined by all the means of diagnosis which are at the command of the dentist today—direct inspection of every tooth, palpation, vitality tests, and any other method deemed necessary; following which an intelligent report of the findings and recommendations can be sent to the physician. I am sure that if this procedure is more carefully followed, our brethren in the healing art will think more highly of us. Referring to the chronic case, the one in which it is most difficult to determine the procedure to be followed, it is well to keep this point in mind—when in doubt, do nothing. Remember that the maxillary sinus, once entered (it makes little difference by which route), never returns to the condition it was in prior to operation. Many oral surgeons and dentists are inclined to be overzealous in treatment of the conditions found in the floor of the maxillary sinus, and in their effort to eliminate all pathologic conditions, cause unnecessary damage to the structures, which results in a long period of treatment for the patient. I would like to stress the importance of keeping the anatomic structure as nearly intact as possible, and never entering the sinus unless it is absolutely necessary. I attempted to point out that one cannot depend on roentgenographic interpretation alone. Diagnosis must be based upon the history of past conditions, present condition and roentgenographic and clinical findings, carefuly checked by any other means at our command.

WHEN AND WHY IS ORTHODONTIC PROCEDURE INDICATED?*

By ERNEST N. BACH, A.B., D.D.S., Toledo, Ohio

THE object of this paper is to present to the mind of the practitioner of general dentistry one phase of the question of malocclusion of teeth in children: "At What Age Is Orthodontic Procedure Indicated and Why Is It Advisable at That Period?" Since this question is one which cannot be settled or agreed on in a moment, it lends itself to discussion.

There are nearly as many variations from the so-called normal as there are individual cases, and in order that we may arrive at some definite conclusion, it seems fitting that we should analyze a few of the more common types of malocclusion which are manifest in younger patients. It is as difficult to generalize on a question of this nature as it is to generalize on the question of replacing missing teeth, for nearly all cases are individual and call for separate solutions.

At this time, we are not so much concerned with the etiologic factors or the prognosis of early malocclusion as we are with the question of recognizing the condition and the time orthodontic interference should be advised.

It is quite generally agreed that aborted cases of malocclusion of the permanent teeth are much to be preferred to corrected or partially corrected cases in the adult, and, of necessity, these preventable cases must be considered before the eruption of all the permanent teeth. This means that we must deal with the child

*Read before the Section on Orthodontia at the Seventy-First Annual Session of the American Dental Association, Washington, D. C., Oct. 10, 1929.

as early as any serious malocclusion is detected; and by early is meant between the ages of 3 and 7 years. The question of orthodontia being primarily one of bone growth and not mechanics, early diagnosis is an essential factor.

DIAGNOSIS

Diagnosis should be given very careful consideration, including full mouth roentgenograms; the patient's history; the parents' and near-relatives' histories (should the case in hand be of an exceptional malrelation); accurate study

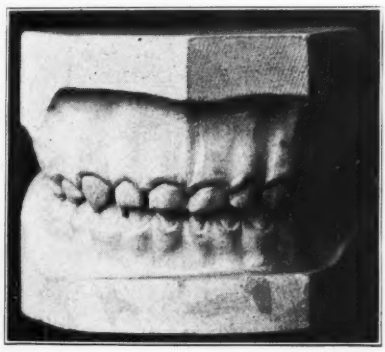

Fig. 1.—Model showing what may rightly be termed normal occlusion for a child, aged 5 years.

models; the diet of mother during pregnancy; the diet of the patient both during infancy and at present; various habits; the nasopharyngeal area; abnormal muscle habits, and the general physical condition.

Even when these factors are taken into consideration and a comparison made of the foregoing data in a number of cases, we may frequently feel that our best judgment is in error.

LeRoy Johnson, on the question of diagnosis says[1]:

> With the increase of knowledge, diagnosis is becoming more difficult. When you think of the child's denture in its true light; when you think of the process of dentition and what it involves, the resorption, loss and eruption of teeth, the growth and differentiation of tissues, the functional interaction of parts; when you think of the inequalities characteristic of growth processes, and of variations in structure due to germinal factors—when you think of the child's denture in its true light, in fact as we know it to be, the problem of the time of treatment holds one

Fig. 2.—Occlusal view of model in Figure 1; showing spacing between the six anterior teeth, in both the maxilla and the mandible.

in abeyance. We may easily recognize differences between the dentures of different children, but to recognize conditions of tooth relations which exhibit a real abnormality is not easy.

Diagnosis means the recognition of disease from its symptoms. Treatment signifies the means employed in effecting a cure of disease and is of course governed by the etiologic factors involved. Treatment is secondary to diagnosis.

1. Johnson, LeRoy: Dent. Cosmos, 66: 779 (July) 1924.

And again we read in "Orthodontics," by B. E. Lischer[2]:

> It is well to remember that a favorable prognosis depends largely upon an early diagnosis, when conditions are such that a comparatively simple treatment will suffice. Formerly it was the custom to postpone most treatments until all of the permanent teeth had erupted, for it was believed that Nature would assist in the correction of the malocclusion, and that most patients would "out-grow" the deformity. Many bitter disappointments have taught us the error of such advice, and strongly emphasize the fact that the severe forms of malocclusion do not develop overnight, but are of slow growth. Hence it follows that years before even an intelligent parent recognizes the impending deformity, the alert diagnostician can advise ways and means for its prevention.

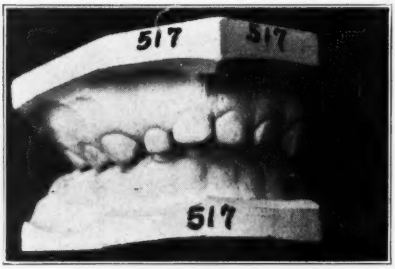

Fig. 3.—Case of extensive overbite and posterior occlusion in a child, aged 3½ years.

Owing to the mechanical aspects of dentition, the self-correction of most forms of malocclusion is an impossibility.

Every fact gleaned from a study of the process of dentition substantiates the orthodontic axiom that *malocclusion and its accompanying deformities are progressive, not static.*

The restoration of normal function during the developmental period is a fundamental principle of rational treatment.

The period of tooth eruption is the period of greatest growth in the alveolar process.

Proper foods, both in quality and quantity, sunlight and exercise play perhaps the greatest part in building the resistance of a healthy and so-called normal body. This is generally conceded by authorities on the subject.

The question of preventive dentistry arises in prenatal life, and may we not likewise say that the question of preventive orthodontia has its origin during this same period? For, as E. V. McCollum says[3]:

> As a profession, we have ignored the developmental factor as the one that is operative in preventive dentistry. There is one way back to better physical development and that is the most fundamental of all, namely, to build up a normal, physical structure, and

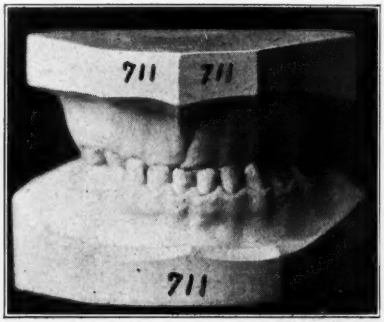

Fig. 4.—Case showing an anterior relation of the mandible to the maxilla.

> that can be done only through proper diet. The child of school age is beyond the reach of help in this respect. His teeth are already formed. This preventive dentistry proposition is largely one of prenatal life and infancy.

It is sound judgment for each of us to avail ourselves of every opportunity to gain knowledge on this subject from authentic sources, so that we may be equipped to furnish our patients with at

2. Lischer, B. E.: Orthodontics, Philadelphia: Lea & Febiger, 1912, p. 130.

3. McCollum, E. V., quoted by Dickerson, Mildred W.: J. A. D. A., 11: 243 (March) 1924.

least elementary information on this important phase of dentistry.

Various stages of growth and predetermined deformities have been produced experimentally in monkeys and guinea-pigs by Drs. Howe, McCollum and others. Caries and constricted arches and other skeletal defects have been produced by certain types of diets and these defects arrested by a change to another form of diet. To some, these facts mean little; to others, much.

There is quite a diversity of opinion relating to the development and size of the deciduous arches up to the period of 5 years of age. E. A. Bogue, in a number of his writings, stresses the point that

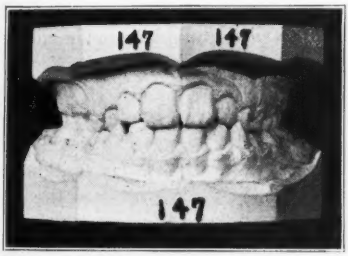

Fig. 5.—Case of constriction of the maxilla, with a practically normal size mandible.

"unless the distance between the maxillary second temporary molars, at the gingivae, measures 28 mm. or more, we may look for a corresponding constricted condition in the permanent dentition from the lack of lateral growth in the jaws at the earlier age, with a resulting malocclusion of many of the permanent teeth." This was found true by Dr. Bogue in a large percentage of the cases in his practice, and while followers of Bogue heartily agree with his findings, others are of a different opinion. E. C. Reed, in a paper given before the Pacific Coast Society of Orthodontists, makes this statement[4]:

> It would seem reasonable that development could be secured more readily and more normally if we set about to assist as soon as we are sure Nature will not properly care for it. I am not prepared to be as radical as Dr. Bogue, who advocated expansion in all cases where the distance between the deciduous second molars is less than 28 mm. Nor have I yet attempted to expand simply because there was not a spacing of the deciduous incisors at 4 or 5 years of age.
>
> As soon, however, as we find the permanent incisors erupting and there is not sufficient room, I believe we should start treatment. This ordinarily is about 6 or 7 years of age. At this age, the child is old enough so one can gain his confidence and easily fit and adjust an appliance.

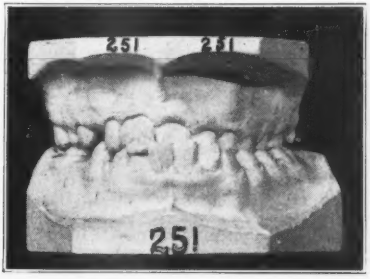

Fig. 6.—Case of flattening of the maxillary process on the right side.

A neutroclusion case is one in which there is a so-called normal relation of the arches anteroposteriorly. A procedure which we find has been of great help and also quite advisable in neutroclusion cases at 3 or 4 years of age, if the six maxillary and mandibular anterior teeth are in close contact, is to keep an accurate check every five or six months, the changes being noted which take place in the size of the arches. If at the age of 5 or 6 years, we find the six anterior teeth still "tightly

4. Reed, E. C.: Internat. J. Orthodon., 9: 175 (March) 1923.

together," it may be advisable to assist Nature mechanically at this time in order to obtain the necessary growth of the arches for the permanent teeth. The form of procedure depends greatly on the size of the jaws and the development which has taken place in the preceding year or two.

Should we find these anterior teeth in contact with each other, and the posterior segments of the arches constricted in such a way as to show that practically no growth has taken place during the developmental period up to the time of the loss of the anterior teeth (5 or 6 years of age), we may feel convinced that mechanical or natural stimulation will prove beneficial.

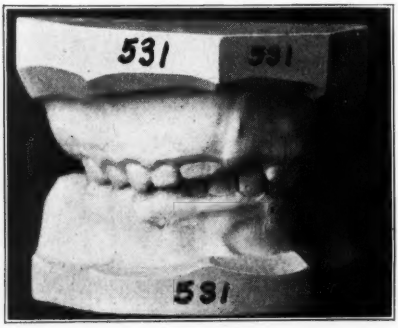

Fig. 7.—Case of constriction of both maxilla and mandible, and excessive overbite.

It is to be regretted if a hasty diagnosis made in a case as above described results in the placing of appliances in a child's mouth unnecessarily at the age of 3 or 4 years.

There are certain types of malocclusion found in the deciduous dentures which we believe should be corrected as soon as possible after detection. These are the types of anterior and posterior occlusion. In the first, there is a protruding relation of the mandible to the maxilla; in the second, there is a receding relation of the mandible to the maxilla.

We feel that these two types of cases can be greatly benefited by early application of mechanical stimulation and proper muscle development. To be sure, proper development of the muscles of mastication will aid greatly in the development of the other osseous structures of the face, as well as those in which we are more intimately concerned. This is essential for many reasons, with which you are already familiar.

Another type of case which should be mentioned here is the one in which there has been an early loss of one or more of the deciduous teeth, from accident, caries or neglect. Wherever this has occurred, a space-retainer should be made and cemented in position to maintain the mesiodistal space resulting from the missing tooth. This retainer should also be constructed so that it will act in the manner of a partial restoration, as far as occlusion is concerned. By this, we mean that the retainer should be in contact with the opposing tooth in order to prevent the overelongation of that member.

Should any of the deciduous molars be lost about the ninth or tenth year, before their due time, it may be advisable to extract the opposing like tooth to allow for the even development and elongation of the bicuspids.

Maintaining the space in a case like this may prove detrimental rather than advantageous, but, if in doubt, we should seek advice in the matter before contemplating the manner of procedure. Often, when there is a full complement of deciduous teeth, extraction is advisable before the teeth begin to loosen. This is true when the permanent successor has erupted either at one side or the other of the line of occlusion, and resorption of

the deciduous roots has not taken place. Although this condition occurs most frequently in the incisor region, discretion must be used in extracting deciduous teeth when the permanent successor has not erupted, and roentgenograms should be consulted for the findings therein.

EARLY TREATMENT

"It is generally conceded that the idea of early orthodontic treatment is correct," writes Charles R. Baker.[5]

We feel that when thorough diagnosis reveals a decided malocclusion, orthodontic interference should be instituted as soon as that condition manifests itself.

There are a number of things which we also hold as being advantageous for orthodontic work at this age:

1. As Dr. Lischer stated: "During tooth eruption there is the greatest growth in the alveolar process." If, as has been stated before, it becomes necessary to work on the deciduous denture, more progress will be made if the work is carried on before apical resorption has taken place. Stimulation of root movement from mechanical sources will have a tendency to produce a growth or change in the alveolar process and probably a similar change in the body of the mandible and maxilla. The possibility of this change becomes less as age increases, but is very pronounced during childhood, when Nature's activity in bone building is at its highest.

2. In most cases, better cooperation is obtained from both parent and patient. There are definite instructions which are given children with certain types of malocclusion, and, unless these instructions are followed, the case is prolonged and satisfactory completion of the work is made impossible. By giving these instructions to the parent as well as to the patient, we have a double check on the work to be carried out. This is likewise true regarding appointments and the frequent carelessness of older patients.

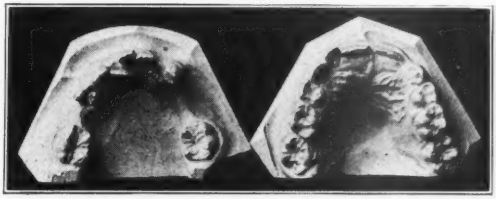

Fig. 8.—Lingual view of model in Figure 7.

3. Duration of treatment in less severe cases is comparatively short. We also find that there is better response in bone growth through stimulation at this age; appointments are better kept, and fewer outside activities detract from the work.

4. Diverting or correcting injurious habits at this age is more easily accomplished. Especially is this true with such habits as mouth-breathing, postural habits and various thumb, finger and tongue habits. Too often, malocclusion of the permanent denture results from one or

5. Baker, C. R.: Indications for Treatment of Malocclusion, J. A. D. A., 14: 777 (May) 1923.

more of these habits established during childhood.

5. At this age, there is little or no objection by the patient to wearing appliances, while at prehigh school or high school age, considerable opposition is met with, and progress is less favorable.

6. One object of early treatment is to bring about normal size and function of the deciduous dentures for that particular age, but the primary object is one of prevention of malocclusion of the permanent denture. Quoting Martin Dewey[6]:

> A few years ago, I made a statement that one of the most frequent causes of malocclusion was the improper care of the deciduous teeth. After several more years of observation, I am inclined to believe that the deciduous teeth, as associated with acquired conditions, are probably responsible for as many cases of malocclusion as any other acquired factor. By acquired factors, I mean those conditions which arise after the birth of the individual which are the result of the environment in which he lives, or rather are conditions which could have been controlled by the proper measures instigated at the right time. The deciduous teeth are formed for the purpose of masticating the food during the early life of the child, and as a result of this mastication, they supply the stimulation that is responsible, to a great extent, for the development of the structures supporting the permanent teeth.
>
> We find an unfortunate condition when the deciduous teeth have been allowed to decay to a point where extraction becomes necessary. The extraction of a certain deciduous tooth will produce a type of malocclusion that can always be foretold years in advance of the ultimate result. The extraction of a mandibular cuspid or molar at a certain age will enable the orthodontist to portray exactly the type of malocclusion that is going to be present at the age of 14 or 15 years, if nothing is done to prevent the occurrence of the malocclusion. The extraction of any particular deciduous tooth will produce a typical form of malocclusion, these having occurred so often that any orthodontist of experience, when told what deciduous tooth has been extracted, can foretell the type of malocclusion that will develop, provided something else does not occur to make the condition still worse. If it becomes absolutely necessary, because of pathologic involvement, to extract deciduous teeth, some means should be employed to maintain the space for the permanent teeth, and some device should be used to keep the remaining teeth in their proper position, in order to maintain a normal approximal contact and a normal cusp relation.

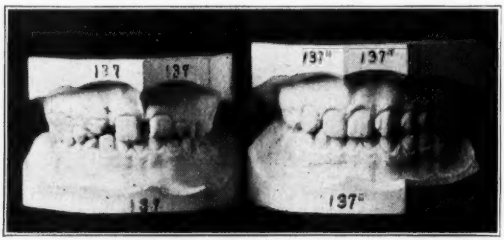

Fig. 9.—Case of congenitally missing maxillary lateral incisors. All buccal maxillary teeth were moved anteriorly to close the space left by the missing teeth.

7. Various writers who have voiced their opinions seem to agree that it is best to work on the deciduous dentition before the roots resorb, a point which has been previously discussed.

6. Dewey, Martin: Orthodontia: Factors Making It Necessary that May Be Partially Eliminated, J. A. D. A., 12: 1188 (Oct.) 1925.

8. Treatment should be begun as early as possible, thereby allowing the patient to reap the earliest benefits resulting from the work. Harold Chapman writes:[7]

> I submit most emphatically that the earlier any malformation of these bones is corrected and the earlier their functions and the functions of the associated tissues are made normal, then the earlier all these parts will be started along proper lines for their future growth and development. It is obvious that any growing thing, whether animal or plant, will suffer the more and become the more deformed the longer such growth and development is permitted to proceed along lines that have led to malformation. This alone is ample and sufficient reason for undertaking orthodontic treatment as early as it is possible to diagnose it, and as early as it is practical to treat it.

been no favorable development up to the age when the permanent incisors should be in position, we generally feel it advisable to use mechanical stimulation.

One of the hardest things, after a thorough examination and study of malocclusion in a child, is to convince the parents of the necessity of work being done for prevention of future trouble. From an argumentative standpoint, it is much easier to wait until the malocclusion is present and then attempt its correction, than it is to try to convince them of the probable future malocclusion hidden in the beautiful deciduous arch when the teeth are all "even and tightly together."

After the one in charge has thoroughly explained the case, making clear the problems and the results involved, his duty is done and his responsibility is over.

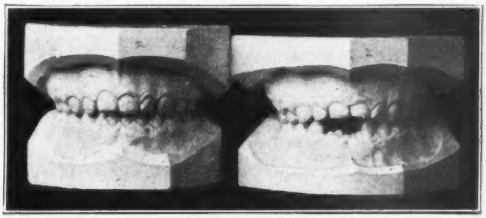

Fig. 10.—Models of a case in a patient, aged 6 (left) and one year later (right). No growth has taken place.

To be sure, there are cases during the developmental period, before 6 years of age, in which it is not advisable to proceed with any corrective measures. These cases, in our practice, have been in the minority, and, when doubt exists as to whether or not orthodontic treatment should be undertaken, the parent has been advised to return with the child for periodic examination. The patient is given appointments at stated intervals of either four or six months, this depending on the type of case at hand. If there has

CONCLUSION

It is hoped that this paper has thrown more light on the question regarding the time orthodontic treatment should be advised.

If the six anterior teeth in the 4 or 5 year old patient are "tightly together" instead of spaced, one should be on the alert for possible future trouble developing in the permanent denture.

We feel that cases involving a protruding or receding mandible cannot come

7. Chapman, Harold: Internat. J. Orthodon., 13: 147 (Feb.) 1927.

under orthodontic care too early, for, in all probability, there is no chance for self-correction.

Should one or more of the deciduous teeth be lost prematurely, the resulting space should be maintained mechanically.

The tendency of our present-day knowledge is to care for our younger patients when prevention is possible rather than wait until the permanent teeth have erupted into abnormal positions and require a much longer period of active treatment, with less favorable results.

The accompanying illustrations show some of the more important types of cases which men in general practice are encountering each day.

Figure 1 is the model from a patient, aged 5 years. There is a fairly good spacing laterally between the anterior teeth. The overbite is regarded as normal.

In Figure 2, the width of the arches is regarded as normal for this age. The spacing between the anterior teeth is more clearly seen here.

Figure 3 is a model from a boy aged 3½ years. There is a fairly wide maxillary arch with protruding anterior teeth and spacing on either side of the lateral incisors. The mandibular anterior teeth are "tightly together," and the mandible is in a position posteriorly from the maxilla. There is also a deep overbite in the incisal region. This is an abnormal relation of the jaws which should be taken care of as soon as possible.

Figure 4 presents a type of case the reverse of that shown in Figure 3. In this case, there is an abnormal relation of the arches, the mandible being in anterior relation to the maxilla. This type of case becomes one of the most difficult to correct in the adult, the earliest possible treatment thus being advisable.

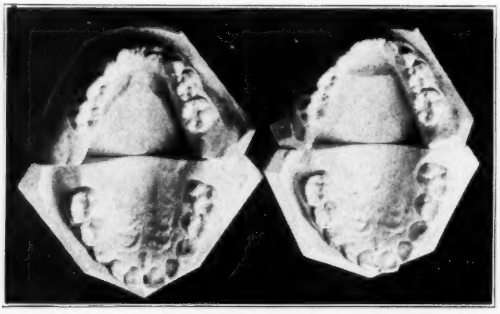

Fig. 11.—Occlusal views of models shown in Figure 10.

Figure 5 shows constriction of the maxilla from the lateral incisors posteriorly from and including the permanent molars. The buccal teeth on either side are occluding lingually with the mandibular opponents. Here, too, there can be no possible correction of the constricted arch except through mechanical means.

Figure 6 illustrates a similar situation to that found in Figure 5, the exception being that only one side is occluding lingually with the mandibular teeth. Some term this a crossbite, but whatever

it is, no correction is possible other than that produced by orthodontic measures.

Figures 7 and 8 are models of the case shown in Figure 6. These are shown for the purpose of indicating where it is advisable to place space retainers. In Figure 8, one can clearly see what deciduous teeth are missing, and at this age, 6 years, it will be three or four years before these spaces will be filled with permanent teeth. During this time, the first and second permanent molars, when they erupt, will drift or tilt forward crowding the bicuspids even before they erupt. Space retainers should be provided on the appliances used to regulate the teeth or, if no orthodontic work is being done, this space should be retained by a separate retainer.

Figure 9 shows two models of the same case. They are shown here to illustrate again a condition when there are some teeth missing. The maxillary lateral incisors are missing in this case and, because of the fact that this condition was discovered early, we were able to move all the teeth anteriorly on either side, bringing the cuspids into the positions of the missing lateral incisors. By this method, the use of bridgework was avoided. On the other hand, had this case come under observation at 18 or 20 years, probably bridgework for replacing the lateral incisors would have been necessary.

Figures 10 and 11 show four models of the same case. The ones on the left were made at 5 years, those on the right, at 6. The child was allowed to go without appliances for a year after the time the first models were made to observe what Nature would do in the way of development, but no change occurred that we were able to measure as far as the teeth were concerned. After another six months, appliances were placed in the mouth and growth is now being observed.

These cases, we feel, have been a fair sample of the types of cases that should be carefully checked by the practitioner who first has charge of the patient.

1307 Second National Bank Building.

DISCUSSION

Norman L. Hillyer, Brooklyn, N. Y.: I should like to ask one question: In the case that Dr. Bach showed of the missing upper lateral incisors, where the spaces were closed up and the posterior teeth were moved mesially to close the spaces, how were the lower anterior teeth arranged? The model did not show clearly to my mind, and I wondered if eventually the tooth material in the mandible might not outbalance the tooth material still left in the maxilla.

Dr. Bach (closing): The paper was rather elementary, and I did not expect any discussion on the matter. Regarding the question of the missing lateral incisors, models of which were shown a few moments ago, there appeared to be more tooth substance in the mandible than in the maxilla. The patient is the son of a dentist and we talked the work over before any procedure was decided on. The father decided that he would rather have the small spaces between the anterior teeth than any bridgework. There is a little space between the cuspid and central incisor on the right side, and between the cuspid and bicuspid on the left, but it has closed up fairly well. Eventually, we expect to polish off the tip of the cuspids and shape them to look more like lateral incisors. The lingual incline of the cuspids does not interfere with occlusion, the overbite is good and the general alinement of the mandibular anterior teeth was good before work was started. There is practically no expansion gained in either arch.

VINCENT'S INFECTION*

By WILLIAM T. WRIGHT, JR., D.D.S., Washington, D. C.

THE following data have been collected from my experiences in the treatment of Vincent's infection, a term applied to certain ulcerative conditions of the oral tissues, associated with the presence of fusiform bacilli and a delicate spirillum.

This disease has been called by several names, such as Vincent's angina, ulceromembranous gingivitis and trench mouth, but is now more commonly spoken of as Vincent's infection. It is thus designated to distinguish it from the real Vincent's angina, which, as the term is commonly used, is a throat infection caused by the same organisms, and somewhat resembling diphtheria.

One of the chief predisposing factors in Vincent's infection seems to be low resistance, from malnutrition, disease, lack of proper rest and exposure. We seldom come in contact with a robust person who has an acute attack of this infection, although a positive smear may be obtained.

The organisms seem first to attack tissue that has been injured or weakened and find lodgment more readily in areas that are not easily accessible to the toothbrush.

Individuals with active or retarded pyorrhea, decayed teeth, retained roots, calculus, gingivitis, malocclusion, ill-fitting crowns, and overlapping fillings, and those whose mouths are in poor condition generally, seem more susceptible to Vincent's infection that those whose mouths are in a healthy condition. This does not imply that a perfectly healthy mouth cannot yield to the infection. In fact, we occasionally find a clean, healthy mouth involved in an acute attack, but this is rather the exception.

In clean mouths, the beginning of the infection is usually in the tissues distad from the lower third molars and upper central incisors, and labiad from the lower incisors. The disease is more often found in unclean mouths where the soft tissues have already received injury due to trauma or from disease, such as pyorrhea and gingivitis.

There seems to be no age immunity for Vincent's infection, but it has been found by us more often between the ages of 18 and 40 and to be more prevalent in the Spring and Fall than at any other time of the year.

We examined 265 smears taken from boys ranging in age from 5 to 21 who were pupils in a private boarding school. Of this number, 22 per cent showed positive smears, but no pupil had lesions or other symptoms of Vincent's infection other than the presence of the organisms. There had been one active case of the infection during the entire school year.

*From the United States Public Health Service at the United States Marine Hospital, Baltimore, Md.

*Read before the Section on Histology, Physiology, Pathology, Bacteriology and Chemistry (Research) at the Seventy-First Annual Session of the American Dental Association, Washington, D. C., Oct. 8, 1929.

a case which was sent to a hospital for treatment.

These positive smears were not confined to any age group, but were distributed over all ages, with more between the ages of 11 and 18. The mouths of the great majority of these boys were in excellent condition. They showed that they had had regular and efficient care, both by the dentist and at home.

In 731 routine smears taken from patients in the United States Marine Hospital, Baltimore, we found 83 per cent to be positive even though only a small proportion of patients had active cases of Vincent's infection. Probably, this large percentage of positive smears was due to the type of men examined, as the majority were seafaring men who, as a rule, take little, if any, care of their mouths.

These positive smears were taken from men ranging in age from 16 to 65, but the great majority were under 40. It is interesting to note that one patient with a positive smear was 55, and was wearing a full upper and lower denture.

In our experience, we find the difference between a positive smear and an active positive smear to be in the appearance of the fusiform bacilli. In a positive smear, both organisms are present, and the fusiform bacilli stains uniformly with the gentian violet stain. In an active positive smear, both organisms are present, and some of the fusiform bacilli take a metachromatic or beaded appearance under the microscope, when a 2 per cent gentian violet stain is used. We have found this beaded-appearing organism always present in smears of either acute or chronic infections, although they are present in greater numbers in the acute cases.

Vincent's infection is a communicable disease, endemic and of widespread prevalence. In certain instances, owing to environment or close association, it may become epidemic. It is presumed to be only mildly communicable where proper treatment is given and precautions are taken, such as thorough sterilization of cooking utensils, dishes and drinking cups.

The exact method of transmitting it has not been agreed on, but since the organisms are present in a large number of mouths, an unsuspecting person may be a carrier and transmit the organism, harmless to himself but probably harmful to others.

It may be transferred from an infected individual to a well one by direct contact, such as kissing, coughing, and close association. It may be transmitted indirectly by using common drinking cups, by transferring lighted cigarets and cigars from one to another and by allowing the dishes and other articles used by an infected individual to come in contact with other members of the family.

On a small boat where the crew was closely associated, one individual suffering from an acute attack of Vincent's infection appears to have spread the disease to the majority on board. This could have been spread by contact with fomites or by droplet infection, lack of sterilization of dishes and failure to isolate the patient.

At this hospital, a patient showing a positive smear is never isolated. A patient showing an active positive smear, with or without lesions, is always isolated. His tray and dishes are sterilized and used exclusively by him during his period of hospitalization.

The symptoms of Vincents' infection vary with the severity of the disease. The first symptoms in all cases are soreness of the gums and teeth, with the gingival margin, especially in the interproximal spaces, painfully inflamed and swollen.

In an acute attack, this is followed by the appearance of ulcers covered with a grayish pseudomembrane which, when removed, exposes a red hemorrhagic surface. This condition is accompanied by increased salivation, headache, general discomfort, nausea, enlargement of the cervical lymphatic glands, constipation, a peculiar and always recognizable sweetish metallic odor of the breath and a temperature ranging from 99 to 103 F. The teeth become loose and are always sore, and it is difficult, and in some cases impossible, for the patient to masticate food. A case may become so virulent that the entire oral cavity and throat are involved.

The milder and more common form is slower in its progress and remains on the surface, not affecting the membrane deeply. This is the type more often found in individuals who give their mouths proper care and attention.

Differentiation between the acute and chronic types of Vincent's infection is one of degree. All the symptoms are present in only the more acute cases. In the chronic type of the disease, errors in diagnosis are often made. Frequently, a chronic form of Vincent's infection is treated as pyorrhea, with unsatisfactory results.

In this type of the infection, the patients suffer no acute pain. They usually complain of bleeding of the gums and general discomfort of the mouth. This chronic type is often associated with pyorrhea, a fact which should not interfere in any way with the diagnosis or cure of Vincent's infection.

We have had at the hospital a number of patients whose trouble was chronic Vincent's infection associated, in some instances, with pyorrhea. On questioning, these men usually said that they had been treated by dentists and were informed that they were suffering from pyorrhea without smears being taken for microscopic examination. The importance of the use of the microscope cannot be too strongly stressed in making a diagnosis.

Physicians, as well as dentists, who do not use a microscope to aid in the diagnosis of mouth and throat infections often err in their diagnoses. Patients have come to the hospital suffering from throat infections which had been treated by physicians without satisfactory results. After a proper examination and diagnosis of Vincent's infection, the cases responded to treatment by a 0.5 per cent solution of chromic acid, used as a gargle.

There are many methods of treating Vincent's infection. The one that we have found to be very satisfactory in all cases is as follows: The patient is first given a cathartic and advised to get plenty of rest, drink water freely and use a milk and orange juice diet. A solution of chromic acid used as a mouth wash three times daily is ordered. A 3 per cent solution is used the first day, a 2 per cent solution, the second day, a 1 per cent solution, the third and fourth days. One hour after each use of the chromic acid solution, the patient must rinse the mouth thoroughly with a 1:4,000 solution of mercuric chlorid in hydrogen peroxid.

On the fifth day, a smear is examined to determine the result of the treatment. Usually, a negative smear is obtained. When such is the case, the patient is instructed to continue washing the mouth with a 1 per cent solution of chromic acid, followed by the same solution of mercuric chlorid and hydrogen peroxid, three times daily for a week. At the expiration of this time, the patient is usually found to be entirely clear, and treatment is discontinued.

In some cases, when the smear is taken after the fifth day, there are present an

occasional fusiform bacillus and spirillum. In such cases, it is necessary to remove all ill-fitting crowns, overlapping fillings and all calculus, as a negative smear cannot be obtained otherwise. After this has been done, the patient uses as a mouth wash a 1 per cent solution of chromic acid, followed in one hour by the mercuric chlorid and hydrogen peroxid solution, three times daily for a period of one week. Usually, at this time, the treatment may be discontinued. In some chronic cases, the treatment must be continued for a few days or even a week longer.

After the treatment for Vincent's infection has been discontinued, the patient's teeth are thoroughly scaled, all diseased roots and defective fillings are removed and thorough prophylactic treatment is given.

We find that the gums of patients who have had treatment for Vincent's infection heal more readily if all extractions are made immediately after the treatment is discontinued.

After this observation, we decided, for experimental purposes, to treat all patients reporting to the hospital for the removal of impacted teeth, especially impacted third molars, with a 2 per cent solution of chromic acid, to be used three times in the twenty-four hours prior to the operation. The tissues of patients so treated healed more readily than the tissues of those not so treated.

After reporting these results, the surgical department of the hospital ordered the routine use of a 0.5 per cent solution of chromic acid, to be used as a gargle three times in the twenty-four hours prior to a throat operation.

COMMENT

From our observation of Vincent's infection, it is believed that it is decreasing, as we did not find so many acute cases this year as we found two or three years ago. At this hospital, 3,158 patients have received dental treatment during the past three years, and while a large number have shown positive Vincent's smears, on routine examination, the percentage of active Vincent's infection cases has been diminishing yearly.

Three years ago, we were averaging, in the clinic, two new acute cases weekly. At the present time, we average approximately three monthly. When one considers the large proportion of positive smears, taken in 731 routine examinations, and the comparatively small proportion of active cases of Vincent's infection found, it is reasonable to surmise that we may be developing a natural immunity to these micro-organisms, or that the causative agent is diminishing in its virulence.

Part of this decrease may be due to the instruction in personal hygiene that is being carried on by different organizations throughout the country.

We speak of diagnosing a case of Vincent's infection in the early stages. We believe that unless the fusiform bacilli present both the uniformly stained and beadlike appearance, there will be no activity at the time, even though the mouth remains untreated.

The most severe case of Vincent's infection that we have ever seen involved the entire oral cavity and throat. The infection had advanced to such an acute stage that the tongue was badly swollen and protruding from the mouth. The speech was not intelligible, and the patient was unable to swallow. As this patient was unable to use either a mouth wash or a gargle, we had to resort to the use of an atomizer, with a 3 per cent solution of chromic acid for the mouth and a 0.5 per cent solution for the throat. In twenty-four hours, after four treatments, im-

provement was so great that he was able to use both the mouth wash and gargle himself. Our experience indicates that acute infections respond more readily than chronic ones.

Chromium trioxid is a caustic or escharotic and any solution from 10 to 50 per cent is a powerful styptic. We know that this acid is destructive of animal and vegetable tissues, and we feel that those who have used chromic acid solutions without beneficial results have used too strong a solution, or have applied the solution only to the infected area. We use the solution as a mouth wash rather than applying it locally, and, in this way, all germs present in the entire oral cavity are reached; which is not the case when the solution is applied only to the ulcerated areas.

We have occasionally had burns of the mucus membrane of the mouth, especially in the buccal folds of the cheek, even when no ulceration was present, after using a 3 per cent solution of chromic acid three times. When this condition arises, we discontinue the use of chromic acid and give a saturated solution of sodium bicarbonate as a mouth wash. After the burns are healed, we resume the use of chromic acid in a 1 or 2 per cent solution.

If a 3 per cent solution of chromic acid causes burns in the mouth on membrane that is not ulcerated, we feel that a stronger solution causes more destruction of the membrane, especially if ulcerations and hemorrhagic conditions are present, and retards rather than expedites cure of the infection.

DISCUSSION

O. A. Oliver, Nashville, Tenn.: Is arsenic indicated in cases of Vincent's infection?

Harold J. Leonard, New York City: What is your experience with sodium borate? Please repeat your statement regarding correlation between active positive cultures or smears and the presence of symptoms.

Dr. Wright: In a positive smear, we find that the fusiform bacilli take the stain uniformly. We do not say that this is full proof, but in an acute case, or just prior to the onset of an acute case, the fusiform bacilli take on a metachromatic or beaded appearance under the stain. We find more fields of the fusiform bacilli during ulceration than at any other time. As for sodium perborate, I have used it about eight or nine times daily without satisfactory results. I have used hexylresorcinol, sodium borate, copper sulphate, vaselin, etc., but as a rule our results have been 100 per cent better with the 3 per cent solution of chromic acid, which we use only the first day, and particularly for the anesthetic qualities. In a severe case, with severe pain, general discomfort and all other symptoms present, two or three treatments afford great relief. The facial expression changes entirely, showing that this treatment relieves the pain, as well as improving the condition. As regards the use of arsenic, my experiences have been with men. I do not think its use is necessary at all in elderly people. In children, the use of arsphenamin has afforded results, but, in some instances, that did not prove the cure.

Nye White Goodman, Los Angeles, Calif.: In using 3 per cent chromic acid as a mouth wash, did you in any way attempt to treat the pockets?

Dr. Wright: Yes, I irrigate the pockets using chromic acid and peroxid alternately in a spray bottle under pressure. I use peroxid for the mechanical effect more than for the oxygen qualities. It effervesces and helps the condition, I believe.

Dr. Goodman: Do you feel that you reached the depth of these pockets? If we go into these pockets, we find them highly infested with these organisms, and I do not see how you reached those organisms with a simple mouth wash.

Dr. Wright: I take all my smears from the pockets.

Dr. Goodman: And you find that you get a negative smear from these pockets after two or three days of treatment?

Dr. Wright: Yes. I get very good results. Occasionally, in a chronic case, it takes longer to get it, but I eventually obtain a negative smear.

Dr. Goodman: How do you determine the virulency of the organism in your specimens?

Dr. Wright: By the appearance. Of course, I might be entirely wrong, but only prior to the onset of the infected case, the fusiform organism with the beaded appearance predominates.

Dr. Goodman: Do you feel that the large fusiform, the beaded fusiform bacillus, is a more virulent type of organism than the small one?

Dr. Wright: I do not think that any of us know.

Dr. Goodman: Have you done any dark-field work?

Dr. Wright: No.

Dr. Goodman: I think that if you will examine these organisms by the dark-field method, you will find that the smaller organisms are quite apparently the more virulent and much harder to treat, and you will find them deeply imbedded in the pockets.

Dr. Goodman: I should like to say just a word on the deep injection of arsphenamin. The idea of the deep injection is not so prevalent among the dental profession as among the medical profession, possibly. What we wish to do in these cases is to build up the resistance to these organisms, and the reaction that we get in these cases, except when the infection is very acute, is that there is hardly any place for the deep injection because it has a tendency to lower the resistance of the individual, and, in these acute cases, the resistance is already low enough.

Harold J. Leonard, New York City: One of our staff has recently been making sections of the gingiva after treatment for Vincent's infection and has discovered the organisms quite deep in the apparently healthy tissue after all clinical symptoms have apparently cleared up. I have wondered whether anybody else has been making sections and staining them for bacteria of the gingival tissue after treatment of this infection.

Dr. Wright: I have not.

RELATION OF OPERATIVE DENTISTRY TO DISEASES OF THE PERIODONTIUM*

By LEROY L. HARTMAN, D.D.S., New York City

THE general practitioner spends the major portion of his time repairing the ravages of dental caries in adult patients. How much of his time is being devoted to prevention? Does he have children come to him as soon as possible after the eruption of each tooth so that he may examine each surface carefully and correct any defects present, or does he wait until the children are brought in on account of toothache?

How much time does the average practitioner spend in studying tooth form? Yet, we hear on all sides the necessity for art in dentistry and the restoration of teeth to normal function.

James Mark Prime has so ably said, as a result of his years of study in the field:

> We have made many errors in our efforts to reproduce the natural forms of the teeth. My observation leads me to believe that perhaps the greatest single error is our failure to reproduce the natural forms of the mesial and distal marginal ridges, because we have not understood their functions. We rarely see a natural mesial or distal marginal ridge that is not broken by a spillway, permitting escapement of food over the ridge and into the wide lingual embrasure. This performs a very definite function in that it limits the field of susceptibility, decreases the occlusal load or stress and gives tone to the large fibrous gum tissue forming the base of the lingual embrasure, which, in turn, is sup-

*Read before the Section on Periodontia at the Seventy-First Annual Session of the American Dental Association, Washington, D. C., Oct. 9, 1929.

ported by a heavy mass of bone. Without this spillway, nature's scheme is defeated.

How many general practitioners do you know who are willing to condemn their own fillings because of poor tooth form, and who remove them and replace them with well-carved restorations?

We hear so much about short cuts in making fillings and casting to dimensions, but only here and there do we find men studying the occlusion and conscientiously trying to make each restoration function in relation to the other teeth in the arches.

In our restorations, we must realize that we are dealing with living tissue, and if we interfere with normal processes beyond the reparative stage, we are responsible for the damage produced.

Just how can an operator protect the periodontium from unnecessary injury? By first making a thorough survey of the conditions requiring attention, by so planning and carrying out each step of this work that the periodontium will receive a minimum amount of damage during the operation and not be subjected to continued injury as a result of poorly contoured and finished restorations.

The diagnosis should be thorough and each operation planned so as to destroy a minimum amount of healthy tooth structure, this depending on the type of filling material best suited to the requirements of the case.

We are called on not only to treat dental caries but also, in many cases, to place fillings in teeth not involved by caries, in which, as a result of abrasion, the summits of the cusps have been worn down so that the dentin is exposed. If permitted to continue, this would result in the cupping of the dentin and interlocking of the cusps.

Small cavities may easily be prepared in these cases just in the exposed dentin and then filled with gold foil.

These are usually spoken of as protective fillings, but this term should have a broader application, in that all fillings which protect the pulp from damage and are so well contoured and finished as to protect the periodontium from undue injury should be considered protective fillings.

If caries has invaded the tooth structures, the sooner its ravages are stopped and permanent restorations made, the less the possibility that the periodontium will lose its normal tone, because of lack of use. More pits and fissures should be filled, and we will have fewer large contour restorations to make.

How may operators protect the periodontium from injury during cavity preparation? First, by learning how to hold their instruments so that they always will have full control of them. The palm grasp, for instance, always permits an operator to make use of a rest and, in that way, control the distance an instrument may go in one stroke.

The rubber dam still has an important place in cavity preparation, not only for the convenience of the operator but also as a means of protection to the periodontium. The rubber dam is not so difficult to apply as some men believe. If the holes are punched correctly, a rubber dam can be applied in a few minutes and be retained in position without the use of ligatures. The rubber dam should be sterilized before use and then just inverted beneath the free gum margin. The field of operation will be free from saliva and the entire process of cavity preparation greatly facilitated by its use. Certain cases call for the use of clamps, but these should be so selected and used as not to injure the periodontium. On re-

moval of the rubber dam, the tissues should be well massaged, and it will be found that no damage will result from its use.

More damage is caused to the periodontium by the use of poorly designed separators and wedges, which do irreparable harm if allowed to be in position for a long period. Some separators, when being tightened, have the tendency to slip rootwise. This may be overcome by placing the beaks in position just beyond the gingival margin of the cavity, then limiting the movement of the separators by placing softened modeling compound between the bows and the nearest incisal or occlusal surfaces. The compound is then chilled and the operator may tighten the separator and have control of the instrument.

Irregularly shaped stones have a tendency to jump out of the control of the operator, but they must be kept true in order to be of any real value in cavity preparation. Sharp burs and cutting instruments cut true and so rapidly that they rarely slip into the soft tissues of the mouth.

In the selection of filling materials, where is each indicated? Owing to the kindliness with which the tissues tolerate fused porcelain, I should like to place it first on the list. It is indicated particularly in gingival third restorations. The gingival bulge should be carefully developed in carving and fusing this material. The margins should not be jagged beneath the free margin of the gum, and no excess cement should be permitted to remain beyond the margins.

Next, I should place gold foil, because of the ease with which its margins can be finished flush with the surfaces of the teeth. In its manipulation, if long-handled pluggers and a hand mallet are used, little shock to the periodontium will result, provided also a sufficient amount of force is exerted by the operator with the plugger before the mallet is used. The pressure should be sufficient to make the fibers of the periodontium tense before each blow is struck.

In the finishing of foil fillings, knives and files should be used in a pull stroke from beneath the free margin of the gum toward the incisal or occlusal surfaces. Extra narrow strips should be used, and disks used with a drawing motion away from the soft tissues. When all of the scratches have been removed, moistened pumice in a rubber cup is used to complete the work. This is indicated today principally in pits and fissures, gingival thirds and proximal cavities in the anterior teeth not involving the angles.

Next would come gold inlays. On account of the accuracy with which they can now be cast, the operator should plan carefully the occlusion, the occlusal form, the proximal contour, the placing of spillways where indicated and the proper location and shape of contact points. The inlays should be finished before being set, and be set without being driven to place by the use of a mallet, and no cement be allowed to remain, especially under the gum margin.

Any high spots on the occlusal surface should be carefully eliminated.

Gold inlays are indicated particularly in large contour restorations and now occupy a prominent position in modern restorative dentistry.

In the plastic group, amalgam holds a prominent position. It still holds a position in larger contour restorations, but calls for a painstaking technic in order to restore tooth form and especially to reproduce good contact points. The matrices must be well planned and adapted, the filling well packed and the filling carved. The finishing, where a

proximal surface has been involved, calls for the application of a separator, especially at the contact point.

Mesial and distal contact points should always be properly located and of the right size and must retain positive relationships between adjacent teeth. Therefore, no filling material should be used which will not permit of this most important protection to the periodontium being established. For that reason, all other plastics I should place in the position of temporary restorations only, which, if permitted to remain too long in teeth, will make the problem of restoring tooth form a much more difficult one.

CONCLUSION

Better operative dentistry will result in the practice of more preventive dentistry. Preventive dentistry will result in less damage to the periodontium and patients will receive the type of services to which they are entitled.

630 West 168th Street.

DISCUSSION

John Oppie McCall, New York City: Dr. Hartman speaks of the restoration of the occlusal form of teeth, and contact, etc., especially in the carving of gold inlays. There is need in this particular procedure for a study of the occlusion, which he also mentioned. But he did not bring the two in together, which I should do. We know that the teeth are subject to wear as we go through life, and that in the middle aged and older patients the cusps do not show their original form, contour and height, as do the cusps in the teeth of the adolescent or the younger adults of from 20 to 25. The periodontist recognizes this as not only a natural result of use of the teeth, but also as a means of relief from excessive stress to the periodontium, which, if continued through too many years, will do harm. These long, pointed cusps apparently do not harm the periodontium during youth. But as we find the bone losing its elasticity through the years, and the pericementum becoming thinner, and with less elasticity, there is need for a change in the occlusion which will protect the peridontium by causing less strain in the lateral and protrusive movements. We must not only study the anatomy of the tooth in which the inlay is to be placed, according to its original form, but also in relation to the anatomy of the other teeth in the mouth, and the age of the patient. The restoration should be carved with all these points in mind. Dr. Hartman spoke of the use of the rubber dam without ligatures. As far as possible, that is very desirable. Of course, a certain amount of ligating of teeth is essential with certain types of cavities, but the ligature should be used with only that amount of pressure, and have such extension under the gingival margin as is necessary to assure the dryness of the cavity and the tooth during the filling operation. Separators are instruments which perhaps do more damage to the periodontium than any other one thing that the dentist uses, and I was very glad to hear Dr. Hartman caution us about their use, or for that matter, any device for wedging the teeth apart or maintaining a space. The safest procedure when a separator is needed is slow separation for a day or two or three, before the operation, and then maintenance of that space by correct instruments controlled in the way Dr. Hartman has suggested. Then the separator will not, in the first place, produce undue and rapid stretching of the fibers at the time of the operation, and in the second place, when the separator is applied, it cannot slide apically and do damage in that way. This means, of course, that the dentist must provide himself with several separators. I do not believe that we can excuse any dentist who does not equip himself with instruments and appliances which will enable him to do his work without damaging the tissues around the tooth while he is concentrating his thought on the crown of the tooth itself. I approve of the use of fused porcelain in cavities which involve contact with the gingival tissue. Wherever it is possible to place fused porcelain inlays in cavities that involve the gum line, that is unquestionably the best material that we can use. One more point with regard to the finishing of fillings: The narrow strips I wish especially to recommend. There is a great tendency to carelessness, I think (it might as well be called that) on the part of operators in finishing the proximal surfaces of their fillings, whatever type of material

they may be, and the narrow strip is one means of avoiding injury which may be very serious to the pericementum on the proximal surfaces of the teeth. The finishing of amalgam fillings requires not merely the careful polishing of the proximal surface of the filling, and this includes, of course, the contact point, but also careful finishing of amalgam at the margin of the cavity, in Class Two cavities. One of the common shortcomings in the amalgam fillings even of those operators who are very careful is failure to remove excess amalgam at the gingival border of proximal fillings. This is due to the difficulty of this part of the procedure, but it is a difficulty which must be overcome. This is partly to be accomplished by the careful placing of the matrix. If the matrix is adapted, as I think it should be, so that amalgam may be carried slightly over the margin of the cavity, to permit of proper adaptation at that margin, there will be an excess which must be removed; and, of course, if the matrix is not used, which I think is an inexcusable error, or even when it is used, if it is not applied with considerable care, there will be quite an excess at this point, and if this excess is allowed to remain, naturally and inevitably damage will be done to the periodontal tissues.

A SCISSOR-BITE DENTURE TECHNIC; USING INCISING ANGLES, PARALLEL PLANES AND DIVERGING GROOVES*

By BRUCE W. AVERY, D.D.S., Whiting, Ind., and SAMUEL K. AVERY, D.D.S., Goodland, Ind.

I

SCIENTIFIC AND BIOLOGIC PRINCIPLES[1]

ONE does not know where investigations in any line of endeavor will lead. Many times, by accident or otherwise, they lead to the most unusual situations, and facts are unearthed that were undreamed of when the investigation was started. To our surprise, from the very beginning of our efforts to demonstrate by clinics the feasibility of deviating from the accepted methods of denture construction and tooth design, our greatest protest came from dentists who assured us that we could not violate the laws of Nature, that teeth were perfected in design by Nature, and could not be improved on. We were entirely unprepared at the time to meet such an argument, and having due respect for any belief which might be entertained on such matters, we remained silent. We knew that a higher power had put teeth into the human jaw, and only the dentist was faced with the problem of putting teeth into an unstable, artificial substitute, in the full denture.

This unexpected opposition led us to investigate the laws of Nature relative to the arrangement and design of the natural teeth in the lower animals. We had accepted it as a fact without investigation, as no doubt the above mentioned dentists had done, that all teeth with immaterial variations were designed like the human tooth. But when we went to the taxidermist, to the veterinarian; on hunting trips and to the museum; and

*Read before the Section on Full Denture Prosthesis at the Seventy-First Annual Session of the American Dental Association, Washington, D. C., Oct. 10, 1929.

1. Part I is presented by Bruce W. Avery.

when we turned to writings of Darwin and others, to our surprise we found that the variations in design and arrangement of natural teeth were many, and that the laws of Nature were the laws of sound mechanical and scientific principles, evolving a tooth for each animal suitable for its environment and type of food. The same design and arrangement that we had been advocating had been in use by Nature for millions of years.

The records of the past ages are exceptionally rich in the history of the tooth, as its density has preserved it when other parts of the body of man and animals were completely destroyed. We will let Darwin and others tell you this history, but we do find that it has never been necessary for man to evolve so efficient a natural chewing machine as have some of the lower animals, owing to the fact that he has mechanically pulverized and cooked his food down through the ages, while necessity has caused some of the lower animals to evolve wonderfully efficient arrangements of teeth and designs of masticatory surfaces.

In grouping teeth in classes for our purpose, we find there are three main types: those of (1) the strictly herbivorous animals; (2) the grain eating animals, and (3) the carnivorous. The foods of the carnivorous animals are such that they have developed a tearing and bone-cracking set of teeth; which do not meet our requirements in our quest for an efficient artificial chewing machine. The grain eating animals, or those that more nearly confine themselves to eating of the seeds of various plants than do the strictly herbivorous, have a crushing and grinding occlusal surface; while the herbivorous animal has an occlusal surface of incising angles and shredding areas. (Fig. 1.) The features embodied in the last two types more nearly meet our requirements in our quest for a masticating surface which will pass through the food with the minimum required pressure, offer the minimum amount of adhesion or reverse pressure on opening and, therefore, minimize displacement of artificial dentures, with ingress of food under the periphery, resulting in distress to the patient and irritated gums.

Animals that are easy of access to all of us and that have these incising and shredding dental features are the cow, the goat, the sheep and the deer families, all of which live on coarse fibrous foods. The horse, the hog and animals of the grain-eating class have more of a crushing and grinding occlusal surface, which requires much greater force than incising and shredding, and this is very evident when we note the size of the head and muscular development of the horses and hog as compared to the sheep, goat and deer family. The cow is evolving into a grain-eating animal, and has a tooth with an occlusal surface embodying features between those seen in the horse and the deer and requiring fairly large muscle and head development. The balance also between occlusal surface and root size is very evident; in fact, these conditions are so well balanced that we believe this rule will apply universally. The more efficient the chewing surfaces, the smaller the roots and the supporting structures, and the less marked the muscular development; the less efficient the chewing surfaces, the longer the roots, the heavier the supporting structures and the greater the muscular development, all being commensurate with the type of food consumed. (Fig. 2.)

We bring these facts before you in order to give you an insight into our reasons for believing that certain features of chewing surfaces render them

Fig. 1.—Deer skull. The masticatory surfaces are efficient and the lower teeth are much narrower than the upper. The inclination of the occlusal planes from buccal to lingual aspect are the reverse of those of the human teeth, the lingual cusps being higher than the buccal cusps on the lower posterior teeth. These are not abraded teeth. The unerupted teeth of lambs show the same cusps and inclination. All herbivorous animals' teeth incline in like manner. Man, because he has pulverized and cooked his food, has never completely evolved from the locked bite of the carnivorous animal, although some inveterate tobacco chewers accomplish that very thing in one generation by wearing the buccal cusps of the lower bicuspids and molars to the gum margin, thereby producing a free unlocked bite, by reversing the buccolingual inclination.

more efficient. If we were to send you with the foregoing knowledge in quest of the most efficient chewing surfaces in the animal kingdom, you would choose animals eating coarse, tough, fibrous foods, but without excessive muscular and tooth supporting structural development, and the teeth would have small, short roots. Without a doubt, you would find the occlusal surfaces composed of incising angles and grooves all working on parallel planes of one inclination, and small, free cleansing occlusal contact surfaces. You would find a free gliding lateral and protrusive movement without interlocking cusps, made possible by all the planes in the same arch inclining in the same direction, as noted in Figure 1, the lingual cusps of the lower molars and bicuspids being higher than the buccal cusps, with the result that the occlusal plane inclines outward as in the incisal plane, the uppers, as a result, being in the reverse inclination.

The lower teeth are usually narrower buccolingually than the upper teeth, which allows for easy clearance of food from the occlusal surfaces in preparation for the next bite. I have spent considerable time watching animals chew, and while in Wisconsin on a fishing trip this summer, I was fortunate enough to have a chance to observe the "Cy Williams" herd of forty or fifty fine dairy cattle, and when it comes to chewing, their "batting average" was high. From my observations, I believe it is a fallacy to speak of the balancing and of the working side and to believe that we close laterally and come to central occlusion. In the animal, both sides are working sides, and they close to central occlusion and move laterally in one direction, and on the following closure, in the opposite direction; a harmony of action similar to the trotting of a horse. Some take two or more excursions in one direction, and likewise in the opposite direction. Others

moved laterally in one direction, till it seemed that the muscle became exhausted, then moved laterally in the opposite direction with the opposite muscle. A few moved in the one lateral direction till exhausted, then rested a moment and continued in the same lateral direction; but I was unable to determine in these cases whether there were dental defects on the one side.

It is the natural thing to come to central occlusion first, as the muscular contractions on both sides are then the same and involuntary. They are followed by a synchronized lateral action, and this is very desirable when artificial dentures are worn, having, as well, both sides working sides at the same time. A patient having acquired the habit through dental defects of chewing on one side only should be trained to use both sides at once, for if there is a working side to a denture and a balancing side, as many of our denture men would have us believe, all of our efforts at balanced occlusion are of no avail, as the balancing side does not assist in balancing until it is too late.

The working side has already met the resistance of the food and displaced the denture. The remedy is to teach the patient to distribute the food over the whole chewing surface, both sides coming into central occlusion, then move laterally; which finishes the grinding, throws the ground food to one side and clears the occlusal surface for each succeeding bite. It is a natural action, and most patients readily acquire it provided the dentures are balanced, free from interlocking cusps and equally comfortable on both sides.

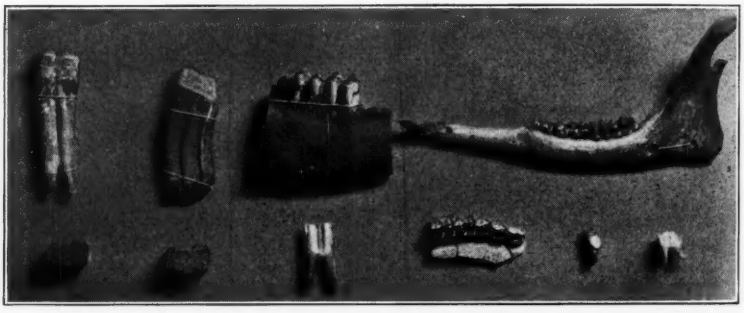

Fig. 2.—Teeth of horse (left), cow (center) and deer (right). The many specimens of various animals examined follow Nature's universal law. The more efficient the chewing surface, the smaller the roots, and the supporting structures and the less the muscular development; all being commensurate with the type of food consumed. In this picture, Nature speaks for herself. In the three animals of approximately the same size and consuming the same type of food, the balance between efficient occlusal and root development may be seen. The mandible of a small horse was so large that it could not be conveniently shown in the picture. All of the occlusal surfaces are more efficient than those of the human tooth, but which occlusal surface would be the choice for an unstable artificial denture?

A comparison of the human tooth with those of other animals shows a history of Nature's trying to adjust herself to rapidly changing environments as considered from an evolutionary standpoint, so that we have in the human tooth an

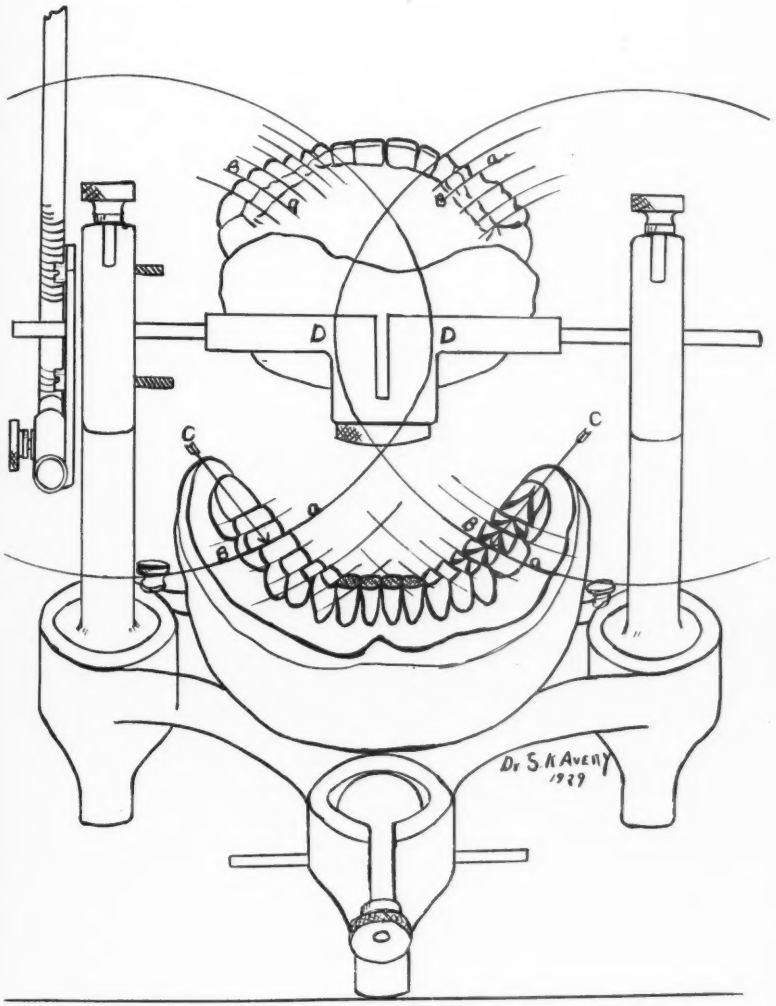

Fig. 3.—Diagram showing that the buccolingual pitch of the parallel planes and incising angles is the segment of a circle around the rotating point on the same side as at *B-A*. The occlusal and incisal planes all incline outward, which causes the direction of stress *(C-C)* to be toward the lingual aspect, and thus seats instead of unseating the lower denture.

occlusal surface and arrangement of teeth especially undesirable for use in artificial dentures, which, at the best, are very unstable and present an entirely different mechanical and functional problem from the fixed natural denture.

As early as 1924, we felt that a departure from the complicated set-up involving compensating curves and inefficient interlocking masticating surfaces was necessary, if the dentist of average ability, or of limited time for study of the problems presented, was to construct efficient artificial dentures rather than use the present hit-or-miss methods. We could not ignore the fact that dentures with a cheap, low cusp, bead of a tooth, many times ground flat on the occlusal surfaces, were in use by many patients with as little or less annoyance than the anatomic high cusp molds, especially when set up in the hit-or-miss manner of the average practitioner (ourselves included). Any chewing efficiency which might obtain from the high cusps was of no avail because of soreness of the tissues, due to lateral and protrusive interference, unless, in chewing, the patient confined himself exclusively to the "chop bite."

In the past, most of the efforts in the construction of artificial dentures have been an attempt to imitate the form and principle of functioning of the human tooth and supporting tissues, even when this form and this principle were not factors in the esthetic appearance and might not help but might stand in the way of efficient denture service.

The movements of the mandible and the relation of these movements to the pitch of the condyle path remain sub-

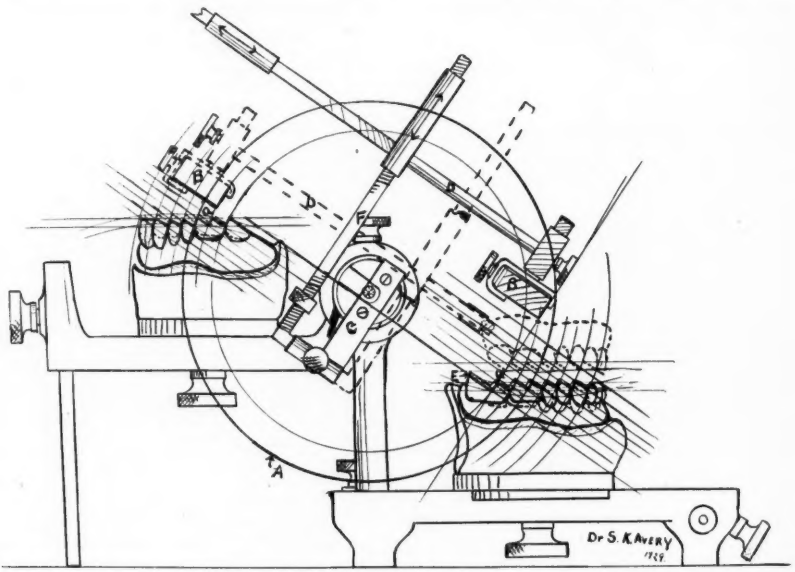

Fig. 4.—An appliance applicable to any adjustable articulator. The pivot *F* on which the arm *D* rotates is held at right angles to the pitch of the condyle path in any position. Therefore, the arm *D* holds the face of the stone *B* so as to set or grind the posterior occlusal plane parallel to the condyle path. The anterior plane is a segment of the circle *A*. The skeleton drawing shows the mechanism applied to the upper teeth.

stantially the same after extraction as they were previous to the loss of the natural teeth, and they have been successfully imitated in many of the better

respective positions, when we have to meet problems of mastication with an artificial appliance that is comparatively unstable, and when entirely different

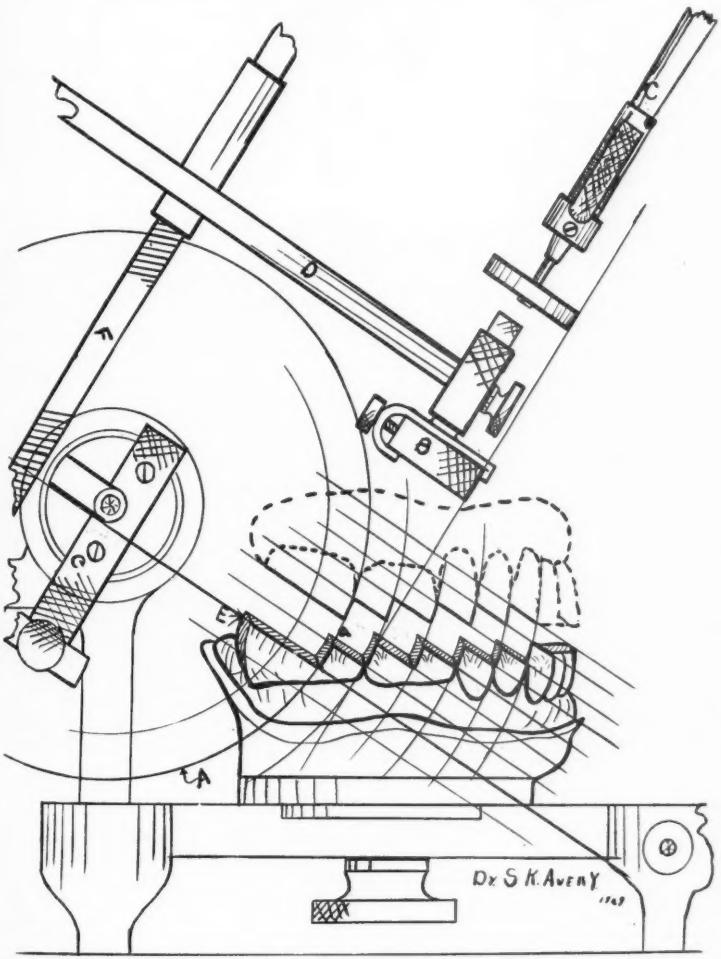

Fig. 5.—Closeup of Figure 4, showing engine handpiece attachment interchangeable with hand-stone *B*.

articulators. But is it advisable to imitate in form and principle the natural teeth, which are fixed securely in their

mechanical principles are involved? Or must we not go into the field of sound mechanical and scientific principles, as

other lines of endeavor have? Our ancestors faced the problem of the artificial locomotion of heavy objects, and they met it by the use of wheels, not legs. The problem of navigation could not have been solved by the use of webbed feet. The air had to be conquered by planes, not by flapping wings.

Our first attempts were to grind the stock teeth of anatomic mold so that they would have plane surfaces which would not interlock or complicate the setting up of the teeth and yet have points or cusps and sluiceways that would cut and grind the food, but would not interfere with each other in the act of chewing. To accomplish this and to minimize the number of various planes and angles that it was necessary to contend with in the setting up and grinding in of a denture, we mounted modeling compound bites on an anatomic articulator and worked many hours in carving planes and angles in the compound, until we ultimately found that only one plane of each tooth must remain constant, being parallel with the condyle path and having a lateral inclination the same amount above the occlusal plane as the pivot of the rotating point of the condyle on the opposite side rises as it passes up and down the condyle path. (Fig. 3.)

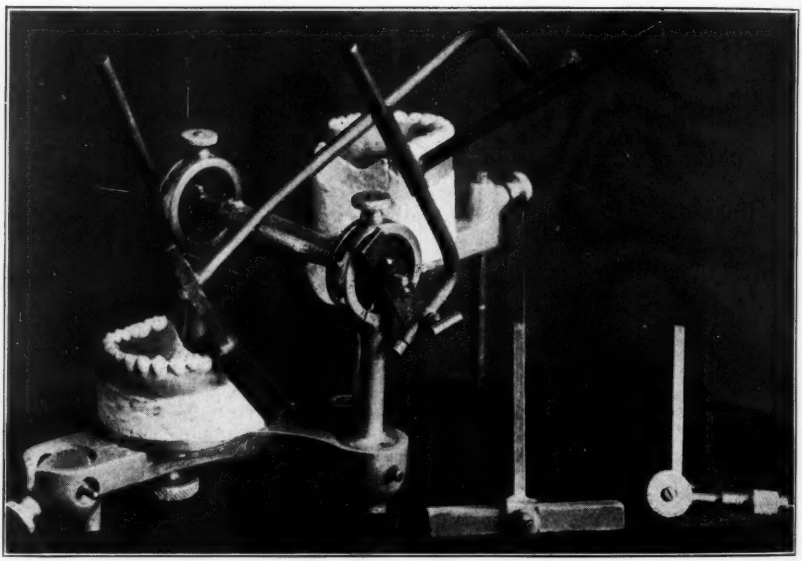

Fig. 6.—Mechanism in relation to articulator and artificial dentures. It is easy to obtain accuracy. By resting the face of the plane-guide against the long anterior plane of the composite scissor-bite tooth, it can be forced into the wax parallel with the condyle path. The stone and handpiece at the right are interchangeable with the plane-guide and are used on cases in which teeth of ordinary type are to be ground in.

This plane that must remain constant is the anterior plane on the occlusal surface of each individual tooth of the lower and the posterior planes of the

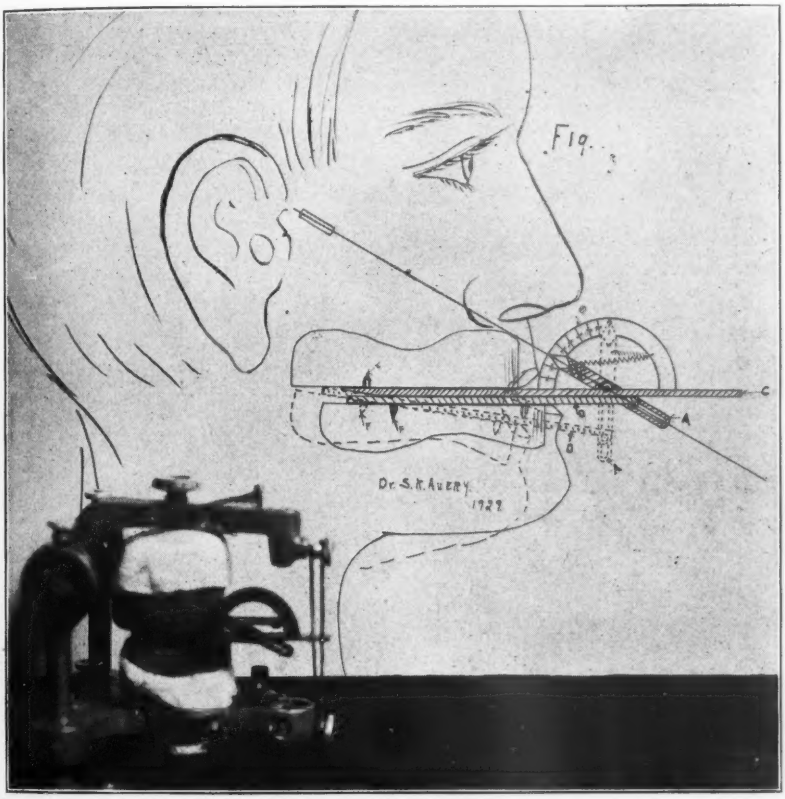

Fig. 7.—Authors' new and complete condyle path register and setting device (with mechanism shown in Figure 8), superseding all others shown. With bites in centric relation and the indicator at 90 degrees, the patient is instructed to protrude till the occlusal planes of the biteblocks and sliding planes of the mechanism (*C* and *D*) are all parallel and in contact at all points. The indicator will then point to the degree of inclination of the condyle path. The opposite side is then taken in like manner. The dials of the setting mechanism of Figure 8 are then set to the same reading or inclination. The sliding scale mechanism is shown on the articulator (below drawing) in lieu of a patient, but, in actual use, is only used in the mouth to determine the inclination of the condyle path. In centric relation or retruded position, the metal plate *D* and indicator *A* are as shown in the dotted or skeleton drawing and the pins *E* and *F* are inserted in the wax opposite each other. Protrusion until plates contact will give the proper reading.

upper teeth. (Figs. 4 and 5, *E*.) It is more desirable, but not absolutely necessary, that the other plane be the segment of a circle in a perpendicular position around the rotating point of the condyle on the same side. (Figs. 4 and 5, *A-a*.) It is also more desirable that the fissures and angles from buccal to lingual aspect are a segment of a circle on a horizontal plane around the rotating point of the

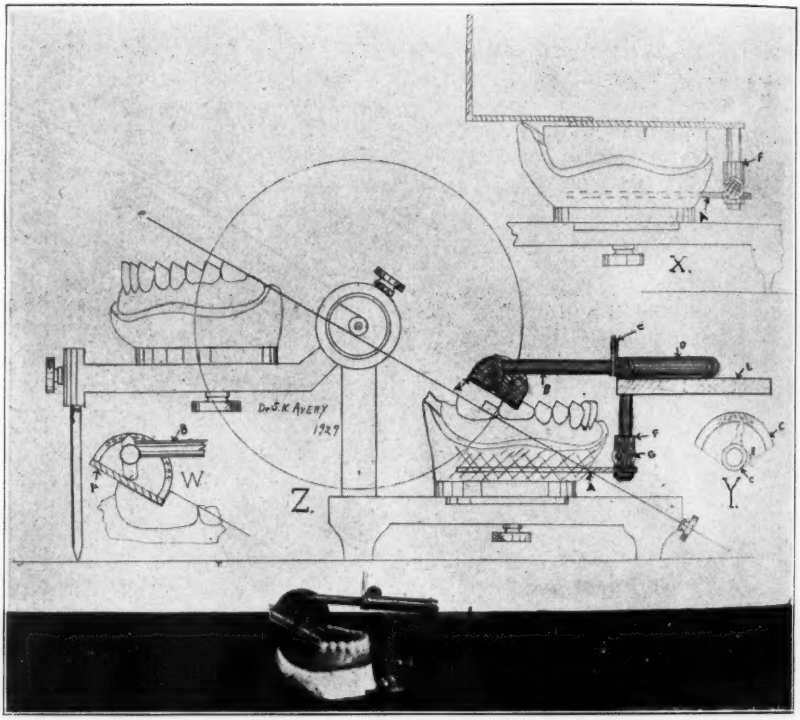

Fig. 8.—Dials (*W* and *Y*) set to the same degree readings as previously determined on the dial of the mechanism (Fig. 7). *X*, upper right, shows the mounting of the holder plate *A*. The upper, then lower, anterior teeth are set to meet esthetic requirements. This is followed by the setting of the lower bicuspids and molars with the plane guide *A*. The upper posterior teeth are readily forced into the heated wax in proper relation to the lower. As shown below the drawing, the lower posterior teeth may be set up entirely independently of the articulator. Any articulator or even hinge may be used to determine the relation of the upper teeth to the lower in centric occlusion. The setting mechanism will swing to either side and dial readings are set to the same readings as the sliding scale (Fig. 7) for that individual side. If an adjustable articulator is used, the condyle paths of the articulator may be set to the same degree reading and the case tested. Arm (*B-D*) slides in the tube *E* and lifts back out of the way.

condyle on the same side as the tooth in question. (Fig. 3, *B-A*.)

This arrangement gives us maximum efficiency in the incising action. By the use of the setting up appliance, all of the planes and angles automatically adjust themselves to the proper position without any effort on our part. (Figs. 6 and 8.) We mention them merely in order that you can completely visualize the desirable features of the technic. To grind or set these planes so that they would be constant necessitated the development of an appliance which is applicable to any articulator. (Figs. 6 and 8.) Keeping this one plane constant allows the dentures

to work in harmony with the condyle paths, gliding over each other without interference and in contact at all times during the lateral and protrusive movements.

This affords a very decided contrast to the many varying plane angles with which we have to contend in attempting to set up anatomic mold teeth with compensation curve and lingual inclination of the lower teeth. Each tooth presents as many surfaces as are found in the cell of a honeycomb, and set at a different inclination, presenting these surfaces to the opposing tooth at many varying angles. These surfaces are then almost wholly obliterated by carving into the form of a tooth, and we are called on to set them correctly geometrically by the aid of the eye only, so that each opposing surface will work in harmony with the many other opposing surfaces in the movements of the mandible. It can be accomplished by a few experts, but time has proved that it is not practical or profitable to spend hours working geometric puzzles in an average dental practice. The great majority have long

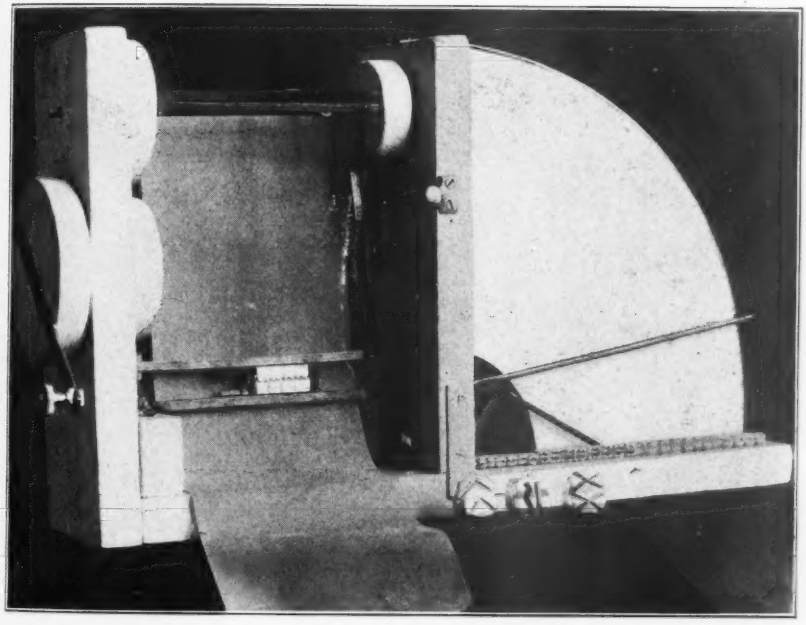

Fig. 9.—Authors' first attempt at a testing machine. The loose end of the rubber dam fastens in the near side of the rocker arm above and acts as a buccinator muscle to keep the food between the teeth, which are interchangeable, as will be noted from the various types arranged in a row beneath the scale. The large models show various occlusal surfaces that it was thought might be efficient. It was soon discovered that the decreased adhesion of the occlusal surfaces or reverse pressure on opening was as important as a low, closing pressure; therefore, a second testing machine was devised (Fig. 10).

ago reached that verdict; and is it because they are "dumb," or is it not because they are intelligent enough to realize that they must confine their efforts to methods that prove practical after a reasonable trial? Many times, we hear the idealists of the profession upbraiding the majority for sending their denture work to the laboratories. Why should they not send their denture work to the laboratory when they have never been presented with a profitable or practical workable technic, one with which they may obtain better or even as good results as the laboratories can obtain for them? Only a few can hope to develop skill enough to obtain even three points of contact.

We do not wish to infer that we have discovered any new laws of articulation. Although we are not very well acquainted with the ancient history of denture construction, we are aware that the laws of articulation were known to the first designers of anatomic articulators, and only intermittently revived by the many present-day articulator designers. They have discovered nothing new, but have

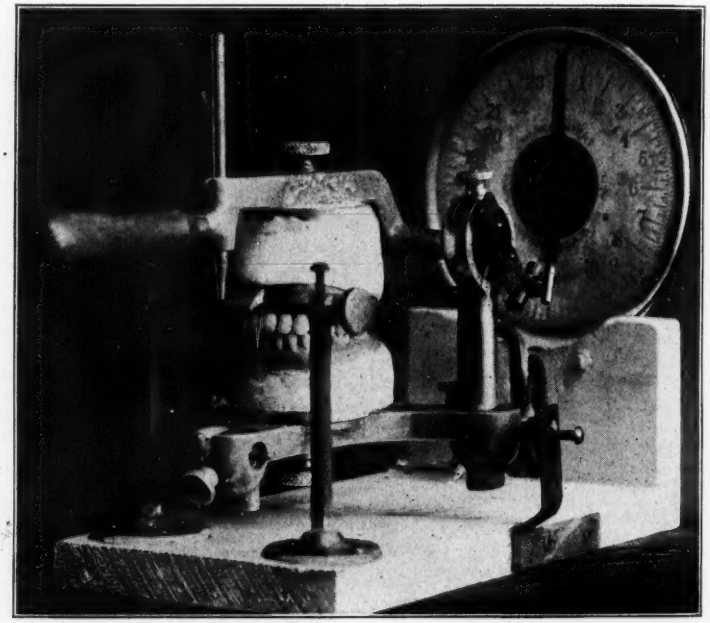

Fig. 10.—Use of standardized wax sheets or other material of uniform consistency for each test to register the closing pressure on the dial, clockwise, the adhesion of the occlusal surfaces or the reverse pressure upon opening being registered counterclockwise. It is hoped to have lathe facilities and time in the near future to make an accurate machine of this type which it is believed will bring the designing of efficient chewing surfaces down to a science founded on facts, such as Drs. Black, Harper and others have brought about in the amalgam field.

only introduced refinements and mechanical perfection. Our appliance for setting up the teeth would obtain the same results on the first adjustable anatomic articulator ever made, or with a simple recording device (Figs. 7 and 8), and scissor-bite teeth, which do not require grinding. They may be mounted on a hinge without facebow or other appli-

dibular movements, although if you have access to an adjustable articulator, it is well to use it, as it will be more convenient.

Recalling the early controversies over amalgam, inlays versus gold foil, and other minor problems, we are aware that we are treading on sacred ground when we attempt to break down the time-hon-

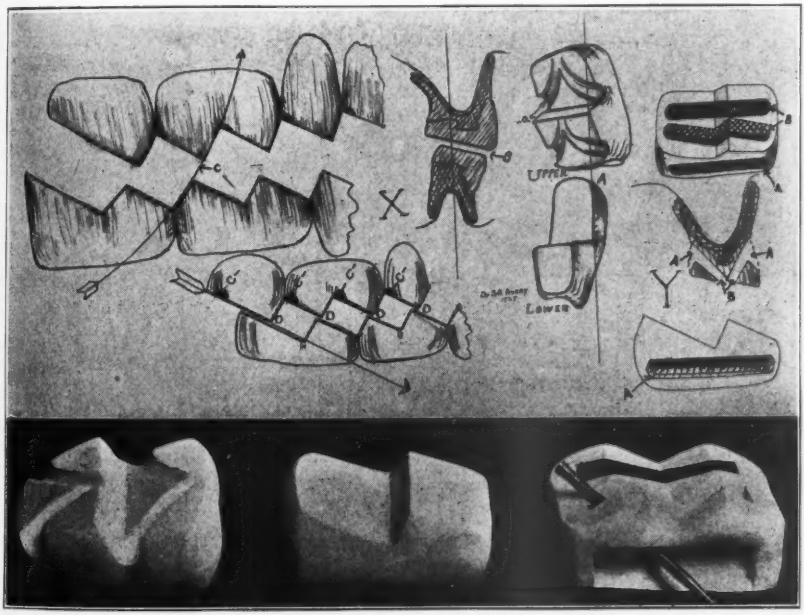

Fig. 11.—Composite tooth forms found efficient with shearing angles at *C-D* and *B* in closing, as well as lateral shearing at *a-B*. The slotted tooth in the models below at the right presents very sharp shearing edges, is made of metal in molars only and passes through the food under low pressure because of its reduced occlusal area. The exit *A* being larger than the entrance slot *B* allows the food to pass through freely. Narrow lowers with a slot to the lingual aspect only work well with the slotted upper or the lower shown in the center. The model to the left shows an efficient porcelain tooth design. Porcelain bicuspids grooved to the lingual aspect and ground to proper pitch are indicated with all of the molar designs.

ance and obtain the proper set-up, one that will work in harmony with the man-

ored fetish, anatomic molds and articulation, so effectively started by Dr.

Sears,[2] and continued by us,[3] and by Dr. Hall,[4] who so ably presented all past efforts at anatomic articulation, and who deserves praise because, in spite of the fact that some of these efforts were his own, he was frank enough to admit his mistakes in an effort to find a more workable technic; and perhaps there may be others unknown to us who have advanced similar theories.

Criticism has been our greatest asset in an effort to reach the ultimate truth, as it has goaded us on to try to prove the soundness or falsity of our theories. Therefore, after determining the proper planes and angles for occlusal surface design, we saw that it would be quite desirable to know which type of tooth would pass through the food with the minimum required pressure, reducing it to the proper consistency in the least number of bites, and then separate with the minimum amount of adhesion of the occlusal surfaces or reverse pressure on opening for the next bite. We decided to make a machine that would register closing pressure, opening or reverse pressure and the number of bites necessary to reduce the food to the proper consistency. (Fig. 9.) The types of teeth are interchangeable, and we have tried to imitate some of the better types of animal teeth as well as to make composites of the more desirable features of all of them. We also mounted some of the types of artificial teeth on the market to determine their comparative value.

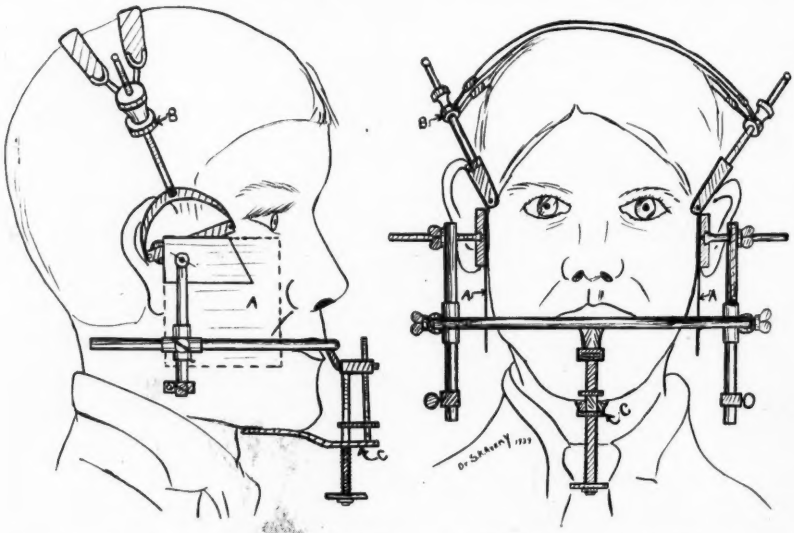

Fig. 12.—Special face bow with chin clamp *C*, which holds the lower bite firmly in position, and head gear *B* for holding condylc path record card *A*.

Our first attempt at a testing machine was not all that could be desired. The

2. Sears, V. H.: Channel Type Posterior Tooth Forms, J.A.D.A., 15:1111 (June) 1928.

3. Avery, B. W., and Avery, S. K.: Dent. Digest, 35:353 (June) 1929.

4. Hall, R. E.: Full Denture Construction, J.A.D.A., 16:1157 (July) 1929.

loose end of the rubber dam fastens in the near side of the rocker arm and acts as a buccinator muscle to keep the food between the teeth. We soon discovered that the decreased adhesion of the occluing machine, by using standardized wax sheets or other material of the same consistency for each test, the closing pressure is registered on the dial, clockwise, and the adhesion of the occlusal surfaces

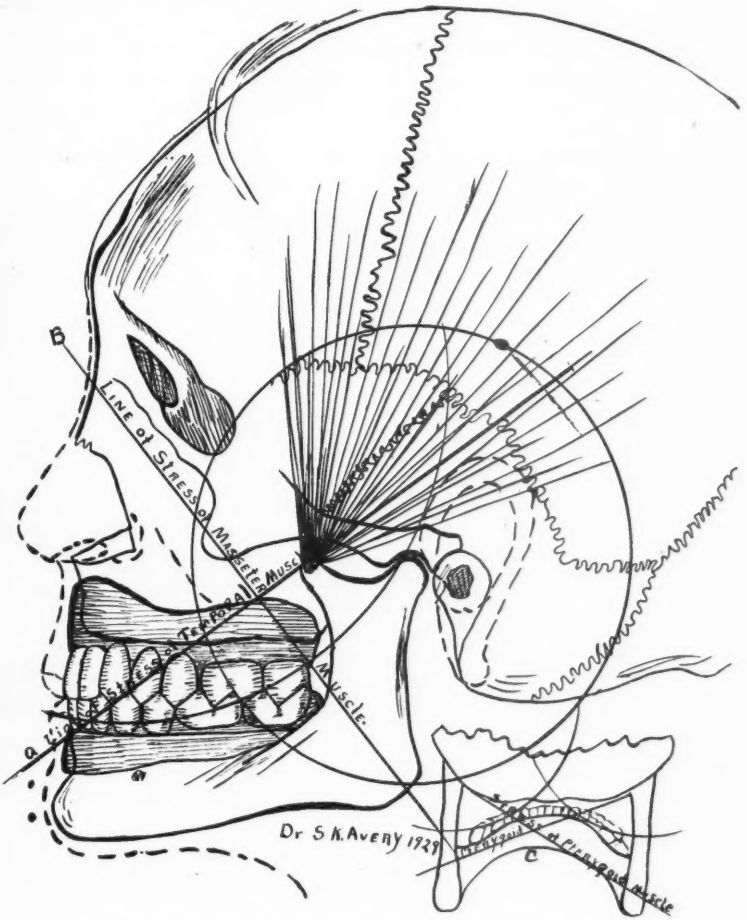

Fig. 13.—Occlusal planes and incising angles of artificial dentures in relation to the lines of muscle stress. Retrusive force at *A*, closing force at *B*, lateral force at *C*.

sal surfaces or reverse pressure on opening was as desirable as a low closing pressure. Therefore, in our second test-

or reverse pressure on opening is registered counter-clockwise. (Fig. 10.) We hope in the future to refine a machine of

this type so it will give very accurate results.

We have made and remade many parts of these testing machines, and no sooner do we have them completed than we see a better way. Therefore, we hesitate to make a report as final as to the good points or defects of any individual tooth, but we have discovered a few fundamental truths. Since a denture is an unstable

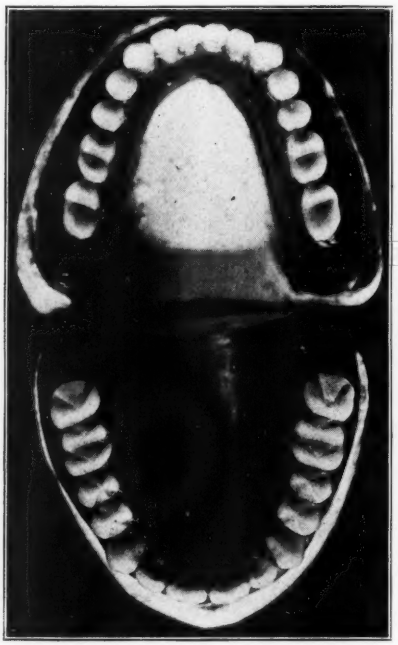

Fig. 14.—Occlusal surfaces of all porcelain scissor-bite denture teeth.

movable appliance and rests on a foundation of tissue that is easily irritated, it must have the smallest possible amount of occlusal contact surface with the opposing denture that is consistent with proper mastication in a reasonable number of bites. We do not believe pits are desirable. Fissures or sluiceways should be broad and lead to the buccal and lingual aspects with an increasing amount of width and depth as they approach the point of food exit. All flat, broad occlusal surfaces or planes should be broken by fissures of this type. (Fig. 11, *A*.) All fissures and planes should be glazed. The occlusal surfaces from buccal to lingual aspect on the lower denture should be narrower than those on the upper. Shearing should be the outstanding fea-

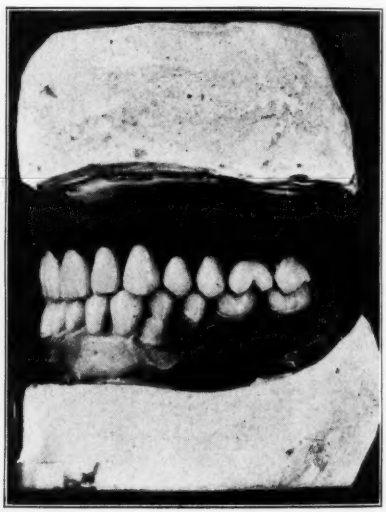

Fig. 15.—Lateral view of all porcelain scissor-bite denture teeth. They do not violate esthetic requirements and may have an overjet or overbite, or both. The overbite is ground at the same angle as the posterior teeth so that the anterior teeth act as a guide and move on a parallel plane with the condyle path.

ture of the occlusal surfaces rather than crushing and grinding, as shearing registers less pressure than any other means of separation. (Fig. 11, *C-D*.) The reason that Dr. Sears' tooth is efficient

is that it has a cutting edge offering less resistance as well as having a low adhesion or reverse pressure. We do not know whether these facts were evident to him when he designed his tooth or not.

From knowledge gained through experimental investigation and clinical observation, we have evolved several tooth designs to include the most meritorious features of all tooth forms. (Fig. 11.) One design of seemingly radical features consists of a molar tooth, preferably constructed of metal with planes, angles and grooves conforming to the requirements previously described but with slots on the occlusal surfaces running mesiodistally and leading through increasingly widening sluiceways with exits at the gingival bucally and lingually, the occlusal surfaces presenting knifelike shearing and shredding edges. (Fig. 11, *B.*)

The other design, which appears less radical, but which we find very efficient, may be constructed of porcelain. It embodies planes and angles as previously described, and has on the occlusal surface diverging grooves of increasing widths and depth leading to the buccal and lingual aspects and allowing for the free exit of food on the broader surfaces. The lower, being narrow, may or may not have sluiceways, and also makes a very efficient combination with the slotted teeth first described.

Owing to the fact that as yet the above-described scissor-bite teeth are not being manufactured commercially, and to acquaint you in detail with the technic and principles involved, my brother, S. K. Avery, will first present a technic for grinding in a stock tooth of anatomic mold whereby they can be made to function in the same manner as the scissor-bite tooth. He will then present a technic showing the contrasting simplicity of technic when the scissor-bite tooth, which does not require grinding, is used.

The mind of man has always been so limited in its ability to grasp the unknown that it has been necessary to cling to the known, even when ceaselessly reaching out into the unknown, with an open mind, willing to sacrifice mistaken hypothesis and grasp the ultimate truth. Ultimate truth, fortunately, is just around the corner, and all we can hope for with our present meager knowledge is to pick up the threads, here and there, and add zest to life, by trying to unravel and convert them into orderly and usable facts. The first technic makes the second understandable and shows how it was necessary for us to cling to the known in order to arrive at the simplicity of the second, or unknown, technic. Our greatest desire is to give you a simple, short, understandable technic, so that you will get definite and accurate results without guesswork or trusting to luck. Luck is a rainbow; while success is the result of knowledge and labor, well spent. If you spend your time chasing the "pot of gold" of luck, you will never meet success, as they do not associate with each other.

II

MECHANICAL AND FUNCTIONAL PRINCIPLES[5]

In taking up the mechanical and functional aspect of our experimental investigations and the resultant technic which we have developed, where my brother left off, I shall divide my paper into three main parts: 1. The creating of a proper mental attitude in the patient toward the wearing of artificial dentures. 2. Our technic for the construction of dentures, using scissor-bite teeth with incising angles, parallel planes and diverging grooves. 3. Follow-up services for rais-

5. Part II is presented by Samuel K. Avery.

ing the patient's morale, and the final adjustment of dentures.

Creating a Proper Mental Attitude in the Patient.—In our efforts at salesmanship, we are prone to paint such an alluring picture for patients that when the dentures are placed in the mouth, and they make an attempt to master the appliance, as to speech and mastication, and to examine it critically as to esthetics, many times with the assistance of friends who have very wonderful dentists of their own of whom your patient has been told, they sometimes feel that they have possibly selected the wrong dentist.

When the denture patient comes to your office for service, the first thing to be considered is an examination of the mouth, noting all possible handicaps that you and your patient will have to overcome. After going over the field and formulating a plan, you can proceed with the selling (if I may use the term) of the appliance which will best meet the requirements of this individual patient.

I find that after acquainting the patient with materials and discussing fees, it is a good policy to impress on the patient that, at first, the wearing of dentures, regardless of how carefully they are constructed, will of necessity be annoying, a crowded feeling resulting in the mouth, with at least soreness from making an unused mucous membrane support a nonresilient denture base. They must realize that, at first, they will find themselves very awkward in the use of dentures when speaking or when masticating food, and that they have the major part to play in the ultimate success or failure of the dentures.

If you have succeeded in gaining their cooperation, you will find little explanation needed later, when an effort to explain might make them feel you were offering excuses to cover a lack of skill.

Patients should be consulted in the selection of the teeth, as to shape, size and shade, not because of their ability to select the teeth most suited, but to satisfy an inherent desire to make themselves into their ideal, which gives you an insight into the most difficult handicap to be overcome. With care, you may guide them so that their desire to improve their appearance will not cause the selection of teeth unsuited to their type. Most patients will select a tooth much too white and small for the most natural effect; which is to be avoided, if you do not wish to have them dissatisfied and disappointed before they have even attempted to master the use of dentures.

Construction of Dentures, Using Scissor-Bite Teeth.—The first thing to be considered is the method of taking impressions. Any one technic will not suit every case. You should use the technic with which you are most familiar, and which gives in your hands the best results. An impression that adheres best may or may not produce the best results in the completed dentures if the pressure exerted on the soft and hard tissues is not balanced properly at its maximum. When the mouth is closed, softer tissues under the dentures should have reached a supporting resistance equal to the harder, but not sufficient to cause a rebound that will displace dentures when opening; for, at this point, the adhesion of occlusal surfaces or reverse pressure of one plate on the other, is to be overcome, and adds to the tendency toward displacement. We have found that most of the soreness of the tissues is caused by tipping and lifting displacement of the dentures, rather than by muscle interference.

The impression will always remain a very important step in the construction of dentures, as to both the comfort and the efficiency that the patient obtains in

their use. We should take advantage of any and all points which will help stabilize and retain the dentures in their proper place on the jaws. Now, having obtained the impressions, you may pour casts with any stone or plaster you are in the habit of using and with which you are getting satisfactory results. The bites are now built up with any baseplate and wax; then shaped and trimmed so that they may aid you in getting markings for guidance later on in the technic.

Here, we find ourselves ready to take the bite, which is done in the usual manner. With all other markings made, we determine centric relation and mark it with small metal clips or V-notched bites, which may be separated and placed back in centric relation at will. With the upper bite block removed from the mouth, we now take the measurements of the face and jaws. By careful digital examination, the heads of the condyles are ascertained, then, with pencil, these points are marked on the face. The lower biteblock is now waxed to the special facebow with the occlusal plane parallel to the side bar (Fig. 12). This facebow is similar to Gysi's in principle, with the exception of the chin-clip (*C*) and headgear (*B*). The lower bite is inserted in the mouth and held in place by a clip under the chin. The pencils are adjusted to the head of the condyles, and with the card holding headgear, cards are placed in the region of the condyle paths, and on the gothic arch plate. We now bring the pencil points into contact with the cards, and instruct the patient to make all possible movements with the mandible, thus registering on the cards the pitch of the condyle paths in relation to the plane of the occlusal surfaces of the bites and the markings of the gothic arch. A line parallel to the occlusal plane is marked on the card by drawing a pencil along the side bar. (Fig. 12, *A*.)

The upper biteblock is now placed in the mouth, and having the patient close with the bites in the same relation as previously registered, we can ascertain whether the jaws are in centric relation, by noting the position of the pencils along the line of the condyle path mark. Should they point more than 2 mm. mesially from the distal excursion of the pencils, the bites are not correct and should be rechecked. Further check-up is obtained by noting the registration of the gothic arch.

The next step is the mounting of the casts, which may be done on any good adjustable articulator. This is done with the use of the facebow and in the usual manner, the operator first attaching the lower cast and then the upper. We are now ready to adjust the articulator in accordance with the record cards obtained from the use of the facebow. Draw a straight line through the markings on the cards of the condyle path inclination, and also extend the line paralleling the plane of the occlusal surface of the biteblock, thus: Bend the card at the biteblock plane line so the condyle path line is on the outside. This turned-over portion of the card is inserted between the biteblocks, giving us the pitch at which the condyle paths on the articulator must be adjusted.

Proceed in like manner on the other side. If you are using an articulator with the adjustable guide-pin plate, it will assist you by adjusting this plate at the same pitch as the condyle paths. You now have a three-point guide and protection to set the anterior teeth by. The articulator being adjusted, the pivotal pins of the grinding arm, being attached to and rotating with the condyle paths, always remain at right angles to the path (Figs. 4 and 5, *F*), so when in place on the

pivot, the grinding arm holds the faces of the stones parallel with the condyle paths in all positions.

This brings us to the part of our technic which deviates from past accepted ideas and introduces new designs and arrangement of the teeth based on scientific principles, to which your attention has been drawn in the paper just read by my brother.

In our technic, we employ parallel planes, incising angles and diverging grooves in forming the occlusal surfaces of the teeth, the planes and angles taking different directions to conform to the pitch of the condyle paths and the segments of circles around the rotating point of these paths, these plane surfaces moving over each other in direct line to the stress of the muscle producing each movement. (Fig. 13.) By this means, we have removed all cusp interference and yet have retained sharp shearing edges with self-cleansing planes to divide the food and grind it. Also we have changed the direction of tilting stress on the least stable of the dentures, the lower, to a seating stress by reversing the lateral pitch from the lingual to the buccal aspect (Fig. 3, at *C-C*), the lingual cusps on the lower dentures being higher than the buccal cusp, instead of as in the old form with the buccal cusp the higher.

With our appliance, which has previously been explained, to guide us, we will take up the procedure for setting and grinding the teeth. Owing to the fact that we have so recently evolved it, our composite scissor-bite tooth is not being commercially produced as yet. Therefore, you may use any one of the good makes of anatomic mold. We begin by setting the upper six anterior teeth to meet the esthetic requirements involved. Then, the six lower anterior teeth are placed to conform to the upper, a slight space being allowed for grinding. The bicuspids and molars are placed by using the guide-plane of the grinding appliance, forcing the teeth into the heated wax, by placing the surface of the plane on the occlusal surfaces of the tooth to be set. (Fig. 6.) This gives it a slight lateral pitch to the buccal aspect, which lessens the depth of the groove at the buccal aspect when ground. After the lower bicuspids and molars are set, with the engine handpiece attached to the grinding arm on the articulator and the emery stone in place (Figs. 4-6), we grind planes which are parallel with the plane of the condyle path on the articulator, at the same time making grooves, and incising angles across the tooth buccolingually, which are the segment of a circle around the rotating point of the condyle path on the same side.

We follow this procedure with the finish grinding by using a hand stone attached to the same grinding arm. (Figs. 4 and 5, at *B*.) We then reverse the grinding arm and proceed to set and grind the lower bicuspids and molars on the opposite side in the same manner. At this time, we give the incisal edges of the six lower teeth a slight grinding. Then we place the upper bicuspids by starting the tooth into the heated wax and forcing it to place by bringing the upper and lower teeth together. We may now note where a slight touching up with the stone is needed to make the occlusal surfaces fit closely together, continuing the set-up and grinding in the same manner with the molars, and doing the same on the other side until all teeth are in position. Then, with a stone, we grind some from the lingual surface of the lower molars so that they present a surface about five-eighths the width of the upper molars. We are ready to inspect the accuracy of the relations of the occlusal surfaces in

their movements over each other, and any little variations may be adjusted at this time; after which we may spot grind or grind in with emery powder.

The above described procedure for grinding in ordinary stock teeth now on the market will not be necessary with our scissor-bite tooth.

Here, we are ready for the trial in the mouth, and the final inspection by the patient and yourself, which has a very important share in making the denture function properly when finished. I find it a good policy to have the patients get out of the chair and look at themselves in a large mirror with the aid of a small one. You may busy yourself in the laboratory. In this way, they may inspect themselves under more normal circumstances, which makes them more satisfied with their dentures when completed. In vulcanizing and finishing, it is very essential that great care be taken in closing flasks that we do not defeat all of our previous efforts in producing an efficient set of dentures.

Having completed the technic of producing the dentures, let us consider the benefit to be derived from the mechanical and functional principles used in this scissor-bite technic. Comfort is the first and most important requirement of the successful wearing of dentures by the patient, and their efficiency depends very much on this comfort. Following through different steps in the act of masticating a bolus of food, we note three separate and distinct movements. First, we have the closing or incising movement, which with this tooth form causes sharp edges to pass each other in a scissor-like action, and not only in the incisal region, but in the molar region as well. (Fig. 11, *C* and *D*.) This scissor action, the most efficient means of separating materials, with the least amount of force, comes at a time when the dentures are most unstable. Thus, this action separates the food into sections, which are carried down to the grinding surfaces.

Here, the two lateral movements come into play. As the one side is grinding by passing down the grooves, the opposite side is grinding by passing up the inclinations and, at the same time, a further shearing action is taking place as the food is being forced over the sharp angles of the diverging grooves. (Fig. 11, *A*.) By narrowing the occlusal surfaces of the lower molars, causing them to offer less resistance, breaking up the broad occlusal surfaces of the upper molars with increasingly widening, diverging sluiceways opening to the buccal and lingual, we enable the patient to force the teeth through the food and clear the occlusal surfaces, thereby eliminating the adhesion or reverse pressure which lifts the lower denture on opening, allowing food to pass underneath, and causing difficulties in making the following bite.

Further, let us note that, by changing the lateral pitch of the teeth in the bicuspid and molar region, we change the direction of stress on closing (Fig. 3, *C-C*), causing the upper denture to seat more securely the lower denture, which stabilizes it; a point to our advantage as this plate gives us the most difficulty by becoming displaced. In taking the direction of the three main muscle stresses into consideration and designing the occlusal surfaces of the scissor-bite teeth with planes and angles, the surfaces of one denture move over those of the other, and up and down incline planes in the exact direction of these stresses, this offering the least possible resistance to their movements. (Fig. 13.) Further, this arrangement allows the dentures to remain in contact at all points in the lateral and protrusive movements.

We have above stated some of the advantages the patient derives from this technic. Now let us note a few advantages to the busy dentist. First, he will find much less of his time consumed in adjusting the dentures after the patient has received them. We have in this technic appliances which are definite guides all through the construction of dentures, taking all guesswork out of the technic.

The Follow-Up Service.—This service for raising the patient's morale and the final adjustment of dentures, we find a most difficult task. Here, the previous concern for the patient's mental attitude will aid us. Many cases will need little adjustment, but the patients should be assured of your willingness to give them any necessary advice or services. Some you will find are "faint hearted," their enthusiasm having decidedly waned, if not altogether disappeared; and at this point you must bolster up their morale. A margin slightly too high, sharp or unpolished; a tongue which objects to being confined to a smaller space than it has previously had in the edentulous mouth; or failure of the patients to consider that it is after all their fight, may bring them back with the dentures in their pocket. Such conditions can usually be overcome by keeping in close touch with the patient till the newness wears off. In the case of women, the appeal to pride is a great aid on this score. With men, this is not so effective. This attention on your part makes them feel that your interest in them is special, and they are much more interested in you as dentists. This also gives you an opportunity to inspect and adjust the dentures, and thereby the patient will sooner master their use. I find it advisable to keep in touch with the patient for some time after he has succeeded in using the dentures, to ascertain whether he is getting the service from them that he has a right to expect.

Now that I have disposed of the technic for grinding in the stock tooth of anatomic mold, I shall present a technic showing, in contrast, the simplicity of technic when the scissor-bite tooth, which does not require grinding, is used. Figures 7 and 8 show the complete technic. With the scissor-bite tooth, we do not require an articulator with adjustable or other condyle movement. We discard headgear and facebow measurements, and grinding and polishing appliances. To the bites built up of wax in the usual manner, of proper length, with flat, properly fitting occlusal planes, we attach a pencil-holding clip, i. e., to the upper biteblock and recording plane, and chin-clip to the lower biteblock. With these in place, we determine the centric relation by the gothic arch method. The inclination of the condyle path is now determined by use of a sliding scale placed between the biteblocks in centric relation. (Fig. 7, phantom drawing.) Then, the patient is instructed to protrude the jaw till both biteblock planes are in even contact with the upper and lower surfaces of the sliding scale. (In Figure 7, note the hand *A* parallel with the condyle path.) The readings on this scale show the condyle path inclination. We must be sure that the bites are in centric relation. The patient may then be dismissed, and the bites and casts are ready to be mounted on any articulator. Only the chin clip is removed. In mounting the casts, a plane is rested against the occlusal plane of the lower bites to hold the attachment for setting the appliance in the proper relation; which allows us to embed a holding plate beneath the lower cast in the fresh plaster used for mountings. (Fig. 8, drawing X, *A-F.*)

For convenience, we mount the casts approximately according to Bonwill's triangles. The upper six anterior teeth are now set to meet the esthetic requirements. The lower six anterior teeth are set to the uppers. We now adjust our setting arm by attaching to the holding plate embedded in the lower cast. (Fig. 8, drawing *Y*, *F-G*.) By the readings on the sliding scale previously obtained in the mouth (Fig. 7), we adjust the setting plane dials as shown enlarged at *W* and *Y* (Fig. 8) to the same reading, which will set plane *A* parallel with the condyle path and at the proper lateral inclination. Starting with the first bicuspid, each tooth is forced to place in the heated wax by placing the setting plane in contact with the mesial plane on each individual tooth and bringing the setting arm to rest. The arm is now rotated to the opposite side. The setting plane is readjusted if the reading is different, and the teeth are set as on the opposite side. The upper bicuspids and molars are readily set by bringing them to contact with the lower and forcing them to place in the heated wax.

In bringing this technic to you, I wish to call your attention again to some of the outstanding features:

1. We have produced dentures that have sharp incising edges and efficient grinding surfaces; remain in contact in all positions of masticating movements; have ample exits for the ground food, and have no unbroken surfaces, thus reducing the necessary force to bring them in contact through food and reducing the adhesion of the dentures to each other or the reverse pressure to the minimum. All movements of one denture over the other are in direct line of the muscle stress that produced the movement. The tipping stress on the lower denture is to the lingual aspect; which stabilizes or more securely seats it. And all of this is accomplished without cusp interference.

2. With the scissor-bite technic, we have an accurate guide to carry us through each step of our construction of dentures, in procuring all of the foregoing advantages. This removes the guesswork from the technic, and does away with the excuse for hit or miss methods, practiced by so many; making it possible for the busy general practitioner to become efficient in the denture department of his practice and making the construction of dentures more of a pleasure and less of a task.

DISCUSSION

Alexander H. Paterson, Baltimore, Md.: It is an interesting fact that, just at this time, there have been presented to the dental profession by three different individuals teeth very much alike in design and principle, each one of the individuals claiming many superior advantages for their particular tooth over and above that which the conventional tooth could ever give. It is strange also that, in the design of their particular tooth, holding in mind that the basic principles of all three are similar, there is a wide divergence of occlusal shape and form when one is compared to another. This being true, isn't it possible that there will be many others of a similar character? And the possibilities are that they will cause almost as much controversy in tooth development as any controversy that has happened over the development of any of the modern articulators. Dr. Bruce W. Avery in his presentation previous to this paper recognizes the similarity of the basic principles upon which all three are founded and unconsciously classifies all of them under one head. It is right that they should be so classified, and they should be called, in my opinion, modernistic tooth designs. To further strengthen my contention of confusion and controversy, I wish to draw your attention to the fact that in addition to the great variance in the occlusal forms of these teeth, there is also a variance in the method of their manipulation and arrangement. One makes use of the principles of the adjustable articu-

lator and employs an adjustable articulator in his arrangement. Another has adopted the method of milling the occlusal surfaces of the bite rims which reproduce the natural curvatures existing in the mouth, and claims that no adjustable articulator is necessary and that the teeth might be arranged with successful results even on a plain line articulator. Dr. Avery and his brother also claim that an adjustable articulator is not necessary and have originated a mechanism that they employ in mechanically arranging the teeth. The suggestion of the Drs. Avery in both presentations as to the elimination of the adjustable articulator and the substitution of a simplified technic, along with a specially prepared tooth, would be acceptable if it carried with it an assurance of complete immunity to all the ills that accompanied the use of the adjustable mechanisms. But, unfortunately, those who make use of the substitution will, in my opinion, have the same discomforts, the same inefficiencies, the same dislocated relationships as those who use the adjustable articulator and conventional tooth forms. The problems of prosthetic dentistry will never be settled by the use of any one specific factor but rather by a collaboration of all the valuable fundamental factors that have been recognized over a long period of years. The technic according to the plan necessary for an adjustable articulator having been described, a simple technic is then described that eliminates the use of any adjustable articulator but does not eliminate all of the preliminary appliances and adjustments on the face. And I contend that the moment any technic involves the use of appliances attached to the human head for the purpose of obtaining any kind of data to be transferred to a mechanism, it is not in any way a simplified procedure. Introduced at this point also is a mechanism originated for the arrangement of teeth. I have always had great pride in my ability to set teeth and have had a sense of security that the art of doing it would never be disturbed by any kind of a mechanical mechanism. I sincerely regret to see the long fingers of the mechanical age reaching out to take the place of the artistic talent that makes men individualists. Reversing the lateral pitch of the occlusal surfaces of the teeth, that is, from the lingual to the buccal aspect, is contrary to anything that I have ever observed in the process of milling the occlusal surfaces of the bite rims with carborundum and plaster in the patient's mouth. I have never had one in which the ground occlusal bite rim indicated in any particular a lateral inclination in that direction, and I can see nothing but antagonism of the jaws' movements with such an arrangement. Of course, the reverse inclination necessitates a tooth of a form that does not measure up to my conception of esthetics. I feel that it is the duty of the designer to produce tooth forms that have all the appearance of the natural teeth, along with a masticatory surface that will give the utmost as far as efficiency is concerned. Certainly, the patient who has lost his teeth is entitled to a substitute that would include all of the art that his teeth had originally.

Victor H. Sears, New York City: The Drs. Avery are to be congratulated on having departed from the human tooth forms in an effort to contrive artificial forms more suitable to the artificial conditions existing in an edentulous mouth. The shearing action of such posterior forms as are illustrated should increase the chewing efficiency of prosthetic dentures used in the open-and-closed movements. The lateral excursions which we have heretofore considered as characterizing the normal human chewing movements would apparently be less effective. On this point, it seems to be a question of deciding by clinical experiments the gains and losses. It is not necessary to arrange all of the mesial facets of the mandibular teeth parallel with the condyle path to make use of the scissor-bite principle as is claimed. In fact, when the condyle path lies parallel with the occlusal plane, as it does in some cases, the scissor-bite would be impossible. From the standpoint of assuring the stability of denture bases, these teeth, arranged according to the recommendations of their inventors, are open to the objection that the cusp inclines are dependent on the angles of the condyle paths of the articulator and, therefore, would necessarily be steeper in cases of high condylar indications, regardless of the requirements of the ridge support. It is in accordance with a simple principle of mechanics that the stability of denture bases depends on directing the closing force at right angles to the supporting tissues. Whenever the mesial or distal inclined planes of the teeth depart from parallelism with the underlying supporting ridge, closing force on any one of these planes causes an anterior thrust on the

attached denture-base in direct proportion to the departure from parallelism. Therefore, it follows that the danger of such dislodging force increases as the condyle paths become steeper. An even distribution of food over all posterior teeth would tend to decrease this horizontal thrust. The fact that so many influences operate at one time makes it difficult to decide matters of this kind from a theoretical analysis. After all, clinical evidence is the court of last resort, and any type of tooth or any system of tooth arrangement must ultimately stand on its merits under actual working conditions. The scissor-bite tooth is worthy of a thorough trial, and it is to be hoped that someone will manufacture it so that we may put it to the practical test.

Harold J. Leonard, New York City: There is good reason to think that dentists are placing certain mental hazards in their way in their intense effort toward discovering and effecting an ideal mechanical relation in the teeth. According to biologists, there is no such thing in Nature as an ideal type of structure to which all individuals must conform in order to be normal. Rather, there is a broad avenue of variation within the limits of which all are normal. In the natural human dentures, there are, under natural conditions and even under the conditions of modern civilization, great variations in form within which, given local function and systemic health, the teeth and their supporting structures will remain healthy. Human teeth usually are formed with well-developed cusps and sulci, to combine the functions of cutting, shredding and grinding. As wear occurs, cusps become worn down and sulci and sluiceways are eliminated, more and more stress is brought to bear. Milling, which tends to mash food into a pulp, certainly requires more force than cutting and shredding. As the teeth wear down, the diameter of the articulating surface is increased. Teeth worn thus therefore usually show normally a greatly increased development of supporting bone. The gingivae appear thickened because of the growth of alveolar process about the teeth. Applying these principles to the making of artificial dentures, we get the following ideas: 1. We are attempting to reproduce an abnormal condition, if we expect to make artificial dentures conform to an exact mechanical ideal to fit all cases. A width of variation of 10 per cent or more either way is the normal condition in Nature. The human organism has the capacity to compensate for such variations from the ideal. The attempt to build dentures to exact ideal balanced occlusion using artificial teeth patterned after certain tooth forms is too difficult for practical purposes and is unnecessary from a biologic standpoint. 2. Narrow grinding surfaces with ample sluiceways for food and elimination of broad contacting planes on the cusps certainly require less supporting structure in natural teeth than wide milling surfaces. It would seem that the same should be indicated for artificial dentures where the supporting structure must be spared as much as possible. The requirements of mastication are for comminution of food and mixture with saliva, not necessarily complete maceration. In other words, shredding is sufficient and complete milling unnecessary. The analogy between the shredding teeth of the sheep or deer and those of man is not perfect, since the use of the teeth is very different. The lower arch in the sheep is much narrower than the upper. The motion of mastication is one of opening the jaw, swinging sidewise, closing and bringing the lower teeth back over the uppers from buccal to lingual aspect, the sharp ridges of the teeth shredding the food in the process. There is no such buccolingual interdigitation as in the case of the milling type of teeth of man. In human mastication, the action is more that of a mortar and pestle. Normally, the milling cusp does not range outside the confines of the opposing fossa in molar mastication. It seems to me that the tendency in denture construction to break away from the closely interdigitated milling type of teeth arranged in close conformity to an imaginary mechanical ideal is a step in the right direction. Even were it possible to establish such an ideal, the uneven resorption underneath soon leads to an unbalanced condition, which is worse in its effects where the teeth are locked in close interdigitation. It seems more practical to diminish the stress on the supporting tissues by changing the tooth forms in the direction of narrow occlusal surfaces, ample sluiceways, small cusp contact planes and, possibly, sharp angle cusps. The prosthetists should also interest themselves in efforts made by physiologic means to make bone constructive rather than destructive in its reaction to pressure stress.

I. Lester Furnas, Cleveland, Ohio: At one of the Association meetings, a wonderful

panacea was given us—emetine hydrochlorid and alcresta ipecac—to take care of all periodontal disease. Even instrumentation was declared unnecessary. I have not used much of that for a long time. I doubt that many of you have. A short time after that, the porcelain inlay came out and became very popular. I have heard men boast that they have thrown away all their gold foil pluggers. I think most of those men went out and looked up some of those gold foil pluggers, if they stayed in practice. Then Dr. Taggart gave us the inlay. That has lasted well, but are we using the inlay every place that we tried to use it when it first came out? It has been one succession of waves through the dental profession. We're faddists. There is a reason for it: I believe there is an excuse for it. No profession has advanced more rapidly than the dental profession. Things have come so fast that we are afraid to turn anything down. We do not know whether this is going to be good or bad. Somebody gets up and paints a beautiful picture of the whole thing and we all fall right in step. That has been the rule in the past. This meeting has been no exception. I still believe there is something in anatomic tooth form. I believe these others will become more or less popular because of the ease of manipulation and the technic is much simpler than some of the technics we have had in the past. I still believe that there is something in all of this mass of scientific work that has been done in the past, and I am not going to discard it. I am not even going to try to use it as a foundation for something that is entirely different and diametrically opposed to what it was all intended for. I realize that in order to progress we have to step out and do this kind of work. The Drs. Avery have certainly done an immense amount of work and they are to be congratulated on that. I would not say anything in the world that would tend to throw cold water on anyone's ambition in that direction. But it seems to me that we have a well beaten path; we know there is something at the other end of it that we have not all reached yet, possibly no one in this audience ever will; but it isn't necessary to start off at a direct angle from this road. I have not graduated into the plane line class yet. My conviction is that these things are a step backward thirty years, and if this is progress, I'm glad to be old fashioned.

B. W. Avery (closing): I don't believe that we will ever reach the ultimate in artificial dentures. We can never settle down to a definite technic. If we did that in everything, we would soon develop a fixed civilization like the Chinese. Dr. Furnas admits that our technic is a simpler one. He says there is something at the other end of the beaten path that we are all looking for. That is a fine statement. We should never settle down to one thing and say that that is the final, the truth. We will never reach the truth in its entirety. As for Dr. Leonard, I think that he agrees with us in general. We do not know which tooth of the mechanical teeth will ultimately develop into the most nearly ideal tooth. We are just in quest of that tooth. It may be a composite of all of these teeth. We hope to evolve a tooth that will have, as Dr. Furnas says, a much simpler technic so that everybody can use it and really get results.

S. K. Avery (closing): Dr. Sears stated that with a condyle path inclination in the plane of the occlusal surface of the bites, this technic and these teeth would not seem to apply. Occasionally, we do have that kind of case, and then one should shift to a tooth something like Dr. Sears' tooth. It would be very suitable there. In the case of an excessively high pitched condyle path, the teeth would be set with recessively less inclining planes as we go toward the mesial aspect, and therefore would overcome part of the excessive pitch and do it very successfully. This change makes no difference: it works just the same. Also I wish to draw attention to the fact that in the scissor-bite teeth, we are trying to follow the anatomy definitely. We are trying to get the stress in such a direction that the interference will be reduced to a minimum. We all know that this is found when two plane surfaces are moving over each other in the direction of the pull. Why does an automobile go up a hill less easily than it goes down the hill or on the level? We have a resistance. We are driving against the hill. In the case of tooth form, the thing to do is to avoid driving against the hill. We wish to drive with the plane or on the level. The stress of the temporal muscle in retrusion or in bringing the lower jaw to centric relation is in direct line with the inclination of the condyle paths. The direction of stress of the masseter muscle brings the stress in the line of the shearing edges or

anterior planes, and the pterygoid muscles pull the jaw or lower tooth surfaces in a direction similar to the grooves or planes of the grooves, which are a segment of a circle around the rotating point of the condyle on the same side. Therefore, we have made an attempt to eliminate the hills, but to retain as nearly as we can the natural anatomic form and as sharp edges as it is possible to make. You will find, if you examine these teeth that they are sharper than any anatomic teeth that you have ever examined and can be made still sharper if you wish to make them so. Dr. Patterson stressed articulators, the idea that we are getting away from anatomic articulators. That isn't the point at all. Use all the anatomic articulators you wish to use. It isn't necessary to use them, although it is I think an advantage. All we have to ascertain is the pitch of the condyle paths and set the planes to suit that movement. By so doing, we have eliminated the locking effect that we get with anatomic molds. And we can get all the movements of the mandible if our articulators are correct, if our movements as we have studied them out are correct. Therefore, in the effort that we have made so far, we have kept in mind at all times this movement, which is represented in the anatomic articulator. If we were eliminating the anatomic articulator, we would not wish to go to the plane line tooth. We particularly wish to retain the art of the natural tooth, if there is any art in it. I have examined many of them and I could not see anything very artistic about them. They may have been, back in the ages, but most of them show the wear that represents an effort of the tooth to get over the bumps or cusps, more or less in the direction of the condyle path inclination, which allows them to function more easily.

THE ORTHODONTIST'S RESPONSIBILITY IN THE PREVENTION OF PERIDENTAL DISEASE*

By EGON NEUSTADT, M.D., New York City

THE duties of the orthodontist are of a threefold nature. One of his considerations is *esthetics;* and this is, in most cases, the only one that the patient himself recognizes. He comes to the office to have "his teeth straightened." It is very seldom that he thinks of anything else, though, in some cases, he may have, in the back of his mind, the idea of improved masticating efficiency as a result of the treatment. This improvement of function is another consideration of the orthodontist and one that he should be just as anxious to discharge as that relating to improvement of the patient's appearance. The third consideration is one of a preventive nature. With the trend toward preventive measures in modern medicine and dentistry, this phase becomes more important. It includes the orthodontist's responsibility in the prevention of peridental disease. Little work has been done along these lines; which is not surprising, as the endeavors of every young science in the field of medicine are primarily directed toward the successful treatment of symptoms. The idea of prevention evolves only after some time, when the study of symptoms has led to the discovery of causes. Orthodontia, as well as periodontia, is a young science, and the problem

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of prevention is destined to play a much greater part in their future than it has in their past.

It may be stated as an accepted fact that several factors enter into the etiology of peridental disease. The more important of them are: low resistance, faulty diet, lack of mouth hygiene, the presence of deposits and traumatic occlusion. With the exception of the first, the orthodontist can, during his treatment, control all these factors, and even this he may influence. He also can influence his patients and develop habits whose benefits will last far beyond the time of his actual appliance work. The necessity of a proper diet during orthodontic tooth movement has already been recognized universally. The same holds true for mouth hygiene. Every patient should be instructed in the correct use of the toothbrush, which not only aids in cleanliness, but also stimulates the gingival circulation. Serumal calculus is rarely found in the mouth of young children, but frequently in patients who are nearing or have reached adult life. The removal of those deposits is just as imperative as the filling of cavities, and each must be done before treatment is begun.

While the above-mentioned preventive measures are all more or less recognized and need to be referred to only briefly, the factor of occlusion should be taken up more in detail; for here lies the great opportunity of the orthodontist and at the same time his most important duty. Here he can do more for his patient than just to "straighten his teeth." Dental arches which show beautiful curves and teeth arranged in perfect alinement are by no means an assurance of prolonged dental health. The normal mesiodistal relationship and proper anatomic cusp interdigitation in centric occlusion mean little for the preservation of the peridental structures. Time and again, those cases, beautifully finished by orthodontists and in centric occlusion, appear after a number of years in the office of the periodontist. This would not happen if more attention were paid to *balanced occlusion* than to centric occlusion. Let us consider now what the prerequisites of balanced occlusion are, and how we as orthodontists can obtain this condition in our finished cases.

Balanced occlusion may be defined as that occlusion which provides for a maximum of tooth contact in the functional movement of the jaws. This maximum occlusal contact distributes the stress of mastication evenly over a large number of teeth. It avoids excessive stress on one or more teeth, a condition which is called traumatic occlusion.

In centric occlusion, for instance, every tooth should have occlusal contact, with the possible exception of the incisors. This precaution for the incisors is taken because they are our weakest teeth owing to the fact that they have lost, with the introduction of the knife and fork, the greatest part of their function. The elimination of contact for the incisors refers only to centric occlusion, and it must be seen to that they have contact in other functional relationships of the jaws.

Let us consider next the lateral excursions in a balanced mouth. In a lateral movement to the left, the left side is called the working side and the right side the balancing side. Contact is desirable on as many teeth of the working side as possible: molars, bicuspids and cuspid. On the balancing side, it is not necessary that more than one or two teeth be in contact. With this arrangement, the movement takes place in the following way: On the working side, the labial cusps of the lower teeth slide

up the incline of the labial cusp of the upper teeth, while, on the balancing side, the labial cusps of the lower teeth come in contact with the lingual cusps of the upper teeth. This maintenance of contact on the balancing side, while desirable, for obvious reasons does not attain the importance that it has in the work of the prosthodontist. If no contact on the balancing side is obtainable, care should be taken that the cusps on the working side are not too high and of too steep an inclination. I shall later on discuss more closely the relationship between cusp height and peridental disease, but it might be mentioned here that a long cusp increases the amount of horizontal stress brought to bear on the tooth. The investing tissues, on the other hand, the peridental membrane and alveolar bone, while they are very resistant to vertical stresses, are easily undermined by horizontal pressure. This fact has been disclosed by clinical observation and also by histologic examination, which shows that a force exerted in the long axis of the tooth is taken up evenly by all the fibers of the peridental membrane; an oblique force engages fibers in limited areas only, and if the force is continuously repeated in the same direction, the fibers and the bone in the limited areas break down under the excessive stress.

Balance in a protrusive bite means cusp contact in the molar region while the incisors are edge to edge. Fortunately, as orthodontists, we are nearly always able to produce this condition merely by depressing the incisors to the desired degree. In cases in which an extensive tooth movement is not indicated or not desired by the patient, the incisors should at least be placed so that they all have simultaneous contact. If the cuspids can be included in the contact of a protrusive bite, they will be able to take up a large amount of the stress. Cases which lack protrusive balance are the most frequent and most trying that the periodontist is called on to treat. They must for this reason receive special consideration in this paper. They are called excessive overbite cases, and it is known that they sometimes present difficulty even for the orthodontist. A great amount of mystery and speculation surrounds them, and the question has been asked frequently as to whether they are caused by an infraversion of the molars or an elongation of the incisors.

To answer this question, we must first recognize the fundamental fact that our teeth have an inherent tendency to grow if not stopped by occlusal contact. This growth of the tooth is accompanied by growth of the peridental membrane and alveolar bone in the same direction. The tooth, therefore, does not grow out of its socket, but rather the socket grows up with it. The length of its clinical crown remains the same. We can notice this phenomenon of growth and elongation on every tooth in the mouth. We see molars elongate when they have lost their antagonists. They grow, and keep on growing, until they meet the alveolar process of the opposing jaw. We see bicuspids elongate after the loss of the deciduous molars in the opposing jaw, and the curve of Spee is to a large degree dependent on the time and the circumstances under which the deciduous molars are shed. We see incisors elongate when they have no contact; and they have no contact when they are in certain malpositions. If the lower incisors, for instance, are in lingual positions, and are not restrained by normal contact with the cingulum of the upper incisors, they will elongate until they meet the gum tissue of the upper jaw.

We therefore find an excessive overbite in every case of lingual position of the lower incisors, or labial position of the upper incisors, or even labial position of the lower incisors (as in mesioclusion), and we do not find it in any other condition. It would be strange to assume that of all the different types of malocclusion accompanied by abnormal function, habits and muscular action, underdevelopment in the molar region occurs only in those cases in which lower incisors definitely have lost their contact with their antagonists. And that is just what those assume who consider excessive overbite a result of infraclusion of the molars. No mathematical proof can be furnished; only the biologic proof of tooth eruption or elongation which takes place whenever occlusal contact is missing. It takes place when molars have no contact; it takes place when incisors have no contact. In both cases, teeth elongate, and if normal conditions are to be established, elongated teeth must be depressed.

So much for the etiology of excessive overbite. Its treatment is imperative. There is no other condition that causes more harm to the peridental tissues than lack of balance in a protrusive bite. Not only do the incisors have to bear excessive stress when they are edge to edge, but while they are being brought into the incisive position, the lower incisors slide along the lingual surface of the upper incisors and exert a strong pressure in a horizontal direction. I should like to recall what has been said about horizontal pressure and the inadequate resistance of the peridental tissues against it. I also should like to recall what has been said about cusp length in the consideration of lateral balance. In the protrusive movement, the length of the cusp must be measured, for the upper incisor, from the point of contact with the lower incisor to the incisal edge. The higher up on the cingulum the lower incisors bite, the greater is this distance and the greater the trauma to the upper incisors. The same applies to the lower incisors, for action and reaction are equal.

It is true that, in the period of youth, even excess stress can be borne by the tissues without apparent harm. But we ought to think of those years when declining vitality and lowered resistance make the disastrous effect of abnormal function and disuse evident. Then it is frequently too late for depression. Shortening can give only partial relief. Then desperate measures are resorted to, as in the use of splints or onlays on the molars. The onlays tend to depress the molars in time, while the incisors elongate somewhat farther because they are taken out of contact entirely. After some time, the condition is worse than before, although occasional adult cases give fairly satisfactory results.

The treatment of excessive overbite consists in depression of the elongated teeth. The amount of depression required can be determined by frequent examination of the teeth in protrusive bite. The depression itself is accomplished as readily as any other form of tooth movement and any one of the commonly used appliances can be applied to advantage, although the bite plane sometimes causes damage while in use. Besides the depression, the proper labial inclination of the incisors must be established. If we visualize the movement of the teeth in protrusive bite, we can understand easily that incisors in more or less vertical position are subjected to greater trauma than teeth with the same "incisal cusp" length and a more pronounced labial inclination.

We have stated that elongation of teeth is accompanied by the growth of

the alveolar bone and the peridental structures along with the tooth, so that, in the end, it can be said that the whole alveolar process is on a higher level, while the length of the tooth crown visible in the mouth has remained the same. This elongation is, as pointed out above, treated by depression of the tooth, in which the peridental membrane and the alveolar bone again participate. There is another condition simulating the one described which has another etiology and therefore requires another treatment. Apparent elongation is based upon the biologic fact that, during the life of the tooth, the investing tissues recede and the clinical crown actually becomes longer. On the other hand, while the crown of the tooth thus grows apically, its size is in normal cases continually diminished through wear from the occlusal surface. Under normal conditions, then, the total length of the clinical crown remains about the same. If a tooth has no occlusion and no wear takes place, the clinical crown becomes too long. This tooth presents in the configuration of its occlusal surface the features of a newly erupted tooth, while the recession of the gums and the bone indicate its real age. It looks out of proportion as would the face of a baby on a grown person. Before such a tooth can be brought into balance and before it can become a useful member of the dental apparatus, natural wear must be simulated by artificial means and its crown shortened through grinding. In many cases, only one group of teeth needs shortening, while the remainder show signs of sufficient natural wear. A typical example is a case of distoclusion in which, because of the abnormal distance between the upper and the lower incisors, no functional wear has taken place. The incisal edges in such cases show well preserved mamelons even at an age of 18 or 20 years.

There are also cases in which the lack of functional activity was not limited to one group of teeth but extended over the whole denture. The cause lies in a faulty diet which during the early youth of the patient did not include sufficiently hard foods. There was, therefore, no necessity for vigorous triturating excursions and lateral movements were limited considerably until a firm habit was established. We may see two patients in our offices, both 16 years old, with similar occlusal conditions, and still presenting different features. One of them has used his teeth and produced wear; the other has unblemished occlusal surfaces that resemble pictures in our anatomy textbook.

How can we influence this patient? Let us bear in mind that, in the evolution of dentition, the tooth form has always decided the form of the temporomandibular articulation. The long cusp teeth of the carnivorous animals, for example, have produced a joint that permitted only hinge movement. If the shape of the teeth has such an influence on the functional movements, then we understand that a correction of diet will have no beneficial effect on a patient with established habits. The grinding of the long cusps and the elimination of the locked occlusion must accompany the corrected diet so that the patient is not only forced but is also able to make wide lateral excursions.

In the instances described so far, grinding was merely resorted to as a means of producing the effects of natural wear. Sometimes, it is also indicated in certain malformations of the occlusal surfaces, such as abnormally heavy cingula on the upper incisors which produce trauma in protrusive movements;

or pronounced marginal ridges on the bicuspids which produce traumatic stress in lateral excursions because they come in contact with the opposing cusps instead of the latter sliding smoothly through the sulci and embrasures. In this category belongs also the abnormally long upper cuspid because it limits wide lateral movements and so tends to preserve long cusps.

We are aware of the fact that normal occlusion is an ideal condition which we never can hope to establish. Let us then establish balanced occlusion. The examination for balance is the criterion of our success or of our failure. In many cases, when we have corrected a severe malocclusion, there remains, at a time when we wish to dismiss the patient, one or the other tooth in a slight malposition; a cuspid somewhat out of the line of the arch; a bicuspid in moderate torsiversion. The patient has come to the office for a number of years and is going to high school now; he wishes to discontinue treatment. The parents are satisfied; are we? The crucial point is the examination for balance. A cuspid out of line may or may not produce a serious trauma; if it does, it will endanger an occlusion on whose correction we have expended considerable time and effort. A bicuspid in torsiversion may cause interference in lateral movements because its cusp does not clear the opposing cusps. If a condition of such nature is revealed, what should be done? The best thing is to bring the cuspid into line or to rotate the bicuspid. The next best thing is to shorten the cusps until the interference is eliminated. The worst thing is to send the patient away without doing either.

WHAT SHOULD THE PROSTHODONTIST EXPECT FROM THE EXODONTIST?*

By ROBERT R. GILLIS, D.D.S., F.A.C.D., Hammond, Ind.

VARIOUS attempts to answer the question as to what the prosthodontist should expect from the exodontist have been made, and the answers given vary quite as much as the angles from which the problem is approached.

At previous meetings of this society, papers have been presented wherein the several authors offered solutions which might be said to picture the ideal ridge form for denture bearing as a product of or sequel to surgical interference.

How fine it would be if all denture patients could present those ideal ridge forms when they need dentures!

Believing with Elbert Hubbard that every sick man is a criminal, I am prone to place any blame for unfavorable ridge form right at the door of the patient. Such a decision quite eliminates any necessity for the prosthodontist to "pass the buck" to the exodontist when the denture patient realizes anything less than full satisfaction.

Being so situated in practice that I often serve my patients as both exodontist

*Read before the American Society of Oral Surgeons and Exodontists, Washington, D. C., Oct. 4, 1929.

and prosthodontist, you may find therein the reason for such conclusions.

This paper might well stop right here, except that my attitude stated may need defense.

Perhaps it is fortunate that I have been able to study cases "before and after," often years before surgical treatment and years after denture wearing.

Too often, when the time arrives for the removal of all remaining teeth or tooth roots and preparation of the field for full dentures, the mouth is already a wreck. A considerable period of time has elapsed since the loss of some teeth, and resultant alveolar atrophy has gone far to level portions of the ridge. The field is irregular, to say the least. Infection harbored about the last remaining teeth may have undermined and destroyed much of their supporting tissues. An extensive root-end infection or the presence of deep pyorrhea pockets may actually result in depressions below the general level of adjacent areas.

After surgery in such a mouth, how can the exodontist be held responsible for lack of ideal ridge conditions?

The patient presenting extensive pyorrheal areas has been suffering for years with a serious systemic or constitutional disturbance. That systemic imbalance is not relieved by simple or by surgical removal of the remaining teeth; its destructive effect continues long after the exodontist has done his work and while the prosthodontist is still sweating to make his work satisfactory on a shifting-sand foundation.

Why blame the exodontist? And why should the prosthodontist assume any blame?

I still maintain, as I stated in Boston in 1920, that the surgeon is to be guided by but two considerations: (1) the conservative removal of all pathogenic tissue, and (2) the elimination of unfavorable contours.

If he does less, as to either consideration, he will be more subject to adverse criticism than when he exhibits a bit of over-enthusiasm in his surgery. If he does less than is needed, a second operation becomes necessary, the end-results of which react unfavorably on the patient, physically and psychically, more than if the the first attempt had sufficed.

Perhaps you will understand now why I place the blame on the patient who has allowed such gross evils to develop in his mouth. Occasionally, such development has been due to ignorance, but far more often it is due to his dread of the day when he must wear dentures. He deliberately procrastinates until finally forced to submit on account of oral discomfort.

In past discussions, we heard much about mouths wrecked by unwise, overextensive surgery. Admitting that there may have been a few such cases, I submit that, for each case so wrecked, a thousand others would have been better suited for dentures, if more surgical work had befallen them.

The longer we live, the more we learn.

I sincerely believe that blame for many of the denture failures and for much denture inefficiency referred to ridges subjected to surgical work, during the past ten years or so, was not justly placed.

Denture construction has evolved improved technics and progressed so considerably within the last decade that most denture teachings of 1919 are now recognized as incorrect. Hence, we are inclined to smile guiltily when we think of the "buck passing" of a few years ago.

We are now far enough away from that period to be able to recognize faults in denture technic that could account for

much—yes, most of the trouble encountered.

Causative factors in extensive ridge atrophy, progressive atrophy that necessitated repeated rebasing of dentures, are now recognized in (1) overpostdamming and overextended borders; (2) impinging peripheral borders, too tightly adapted; (3) lack of border extension, which results in lack of a supporting area; (4) precision instruments, unwisely employed; (5) arbitrary instruments and arbitrary technics; (6) occlusion ground into dentures that did not simulate the patient's individual requirements; (7) cusp interference in maloccluded and malarticulated dentures; (8) deep cusped teeth that introduced the unworn teeth of youth to patients whose muscular habits of mastication were senile; (9) use of inappropriate or unsuited cuspidation; (10) errors of orientation in mounting casts; (11) failure to establish needed relations between maxilla and mandible; (12) failure to establish proper associations between jaw relations and tooth occlusions, and (13) failure to conform to the laws of articulation.

Each of these points might be expanded into paragraphs. Suffice it to say that we confess past errors and omissions, hoping that the future may bring forth yet clearer understandings.

Previous essayists have described and illustrated their conceptions of the ideal ridge forms for dentures. How wonderful it would be if each and every patient presented ideal conditions! But we must still be prepared to take them as they come.

Denture technic has now progressed to a point where we can offer very useful and comfortable substitutes for natural teeth. Patients should be advised against delaying too long in having their mouths prepared for and equipped with prosthetic dentures. Remaining teeth should be removed while there yet is a prospect of salvaging tissues on which a good foundation for denture wearing may be developed.

While it seems to be generally accepted that success with dentures depends on an ideal foundation of ridge tissue, this is only a notion. Not one patient in scores presents conditions approximating the ideal, as we conceive it.

Our predecessors in denture making were not dismayed when they encountered flattened ridges. That old master, Dr. Haskell[1] took special pride in his success with flat ridges, declaring that "denture retention depends more upon fair adhesion and correct occlusion" (than upon the form of the seating surfaces).

That more recent dean of prosthetic writers, George H. Wilson, in his textbook says, "Other things being equal, the amount of retention will be in the ratio of the flat surface covered. The common statement that a flat vault is unfavorable for retaining artificial dentures is not well founded. The poor retention often observed in such cases is due to other causes and faulty technic."

The relining and rebasing of dentures to compensate for alveolar atrophy has taught us that the gross, over-all dimension of the denture bearing area, even under not wholly acceptable dentures, does not change through the years, after natural atrophy immediately following extraction has ceased.

A denture built immediately after extraction, and built to the proper peripheral contours, will retain the same border dimensions externally, and, in rebasing, the additional base material is applied only in the altered ridge portion.

1. Haskell, L. P.: Dental Digest, 18:690 (Dec.) 1912.

Therefore, to corroborate Haskell and Wilson, no diminution of retention is suffered by the lessening of the ridge height alone.

If the correct answer to our question is ever found, it will release much mental effort and program space to other lines of study. Perhaps such a settlement could be so only for those who happen to sit in the council at the time, for this topic seems to have arisen perennially for discussion for most of the years that our profession has had a literature. John Hunter touches on it in his text written about 1780, in the chapter dealing with extraction of teeth, and therein he does not approve of "sewing up the gums," saying it is "mostly for shew."

In the *Dental News Letter* of July, 1853, and *Dental Register of the West* of October, 1853, page 60, we may find an excellent description of the surgical operation and its benefits that we are considering today. Therein, A. T. Willard, of Chelsea, Mass., writes

> After extracting the teeth, I clip off all the mucous tissue that filled the space between the necks of the teeth, leaving a smooth border. I then dissect back the fibrous-mucous tissue from the alveolar wall or border about one-fourth of an inch and cut off with a pair of bone forceps the alveolar edge from a fourth to three-eighths of an inch deep; this will allow the edges of the mucous tissue to come together, having the appearance of a cut only around the dental arch. In the cases I have thus far prepared this way, I believe I have saved the patients much suffering and much inflammation, and also Nature the task of removing this same matter by absorption or effusion. By this process, we, in a measure, destroy the mucous excretory follicles around the dental border and thereby they sooner become hard and firm. We shall save the risk of having detached pieces of bone in the gums, to find their way out by abscess or absorption. We shall save the patient most of the disagreeable effects of the effluence from the gums; we can save four months' time in fitting the gums for a permanent set of teeth, and not least, in a pecuniary view of the subject, we have better shaped mouths and consequently easily fitted and handsomer work can be done. But the difference in age, health, and number of teeth to be removed should be the criterion for our government under this operation.

What modern exodontist could give a better description of the operation, its benefits, and its indications and contraindications? And in so few words?

CONCLUSION

The exodontist may remove sufficient tissue to eliminate all pathogenic tissue and unfavorable contours, after which the skilful prosthodontist can still build very satisfactory dentures for every case.

The important thing now is to substitute new facts for old opinions.

EFFECT ON THE TEETH OF TOTAL ABSENCE OF THE SALIVARY SECRETION*

By MARY F. MONTGOMERY, M.D., Chicago, Ill.

IN recent years, the rôle of the saliva in the prevention of dental caries has been the subject of a considerable number of articles in the dental literature. This supposed protective influence has been ascribed to various constituents of the salivary secretion by different authors. A summary of the more common views is given by Spencer-Payne.[1] According to Wallace (quoted from Spencer-Payne), the chief function of the saliva is to keep the mouth clean. Pickerill[2] emphasizes the rate of flow of the saliva as an important factor in controlling decay. The reaction of the saliva has been extensively studied, and Marshall[3] in particular has been firm in his conviction that the ratio of the neutralizing power of normal resting and activated saliva is indicative of immunity from caries. Gies and Lothrop,[4] Gans,[5] Howe and Kenniston[6] and a number of other authors disagree with his conclusions. Again, the lubricating action of the mucus in keeping the mouth clean is thought important by Talbot.[7] The ptyalin, the calcium and the sulphocyanate content of the saliva have also been considered in studies of dental caries.

It would seem that if the salivary secretion were truly of great importance in the prevention of decay, this fact should be susceptible of experimental proof and that there should be some unanimity of opinion on the subject; which there evidently is not. For this reason, it appeared important to publish some recent observations on dogs in whom the salivary glands had been totally removed. The extirpation was performed in from two to four stages. It included total removal of both parotid, submaxillary and sublingual glands, as well as of the orbital glands. The latter, present in carnivora and rodents, are large aggregations of buccal mucous glands, situated in the orbit behind the zygomatic arch, forming a mass about the size of the submaxillary gland. The opening of the duct is at the level of the third upper molar. Their structure and function has been well described by Kehrer.[8] They produce a viscid mucous secretion.

The dogs have been given the ordinary laboratory diet of partly cooked meat and

*From the Hull Physiological Laboratories of the University of Chicago.

1. Spencer-Payne, A. LL.: Brit. Dent. J., 45:1637 (Dec. 15) 1924.

2. Pickerill, H. P.: Brit. Dent. J., 45:1394 (Oct. 15) 1924.

3. Marshall, J. A.: Am. J. Physiol., 34:260, 1915.

4. Gies and Lothrop: J. Allied Dent. Soc., 5:262, 1910.

5. Gans, L. R.: Experimental Study in Salivary Reaction, J. A. D. A., 13:222 (Feb.) 1926.

6. Howe, P. R., and Kenniston, Mildred R.: Am. J. Physiol., 46:28 (April) 1918.

7. Talbot, F.: Brit. Dent. J., 45:345 (March 15) 1924.

8. Kehrer, F. A.: Ztschr. f. rationelle Med. (III R.) 29:88.

bread. Three have received some milk daily. The food has been kept moderately moist and soft, but these dogs show no apparent difficulty in chewing or swallowing dry bread.

It was impossible to say that the absence of saliva in these animals had any effect at all on the condition of their teeth. Since the observation of the teeth was not the primary object of the experiment, no attempt had been made to secure dogs with perfect teeth. Of the six animals used, three had apparently sound teeth. Two of these dogs have been observed for eleven months, and the third for six months since the last operation. In none is there any evidence of caries. The tongues have a slightly fissured appearance, but the buccal mucosa is perfectly healthy and remarkably moist.

We believe one cannot argue that the dog is an unsuitable animal for this type of experiment, because extensive decay is commonly seen in the mouths of dogs received in the laboratory. The three remaining animals used in the experiment had moderate to severe caries at the start. If this decay has progressed, the change has not been striking enough to be noted by one inexperienced in the examination of teeth. We do not wish to deny that the salivary secretion has any function in maintaining the health and cleanliness of the mouth, but we believe that too important a part in the prevention of caries has been ascribed to it. The experiment described indicates that one must look to some other agent than the saliva as the main factor in the preservation of the teeth.

THE NATIONAL ASSOCIATION OF DENTAL EXAMINERS AND THE NATIONAL DENTAL EXAMINING BOARD

By W. S. P. COMBS, D.D.S., Middletown, Del.

FOR years, the dental profession has been interested in reciprocal dental licensure between individual states, and, during the past decade, in nationwide reciprocity. While reciprocal relations between individual states or groups of states have been satisfactory to a certain extent, the benefits to be derived through such an arrangement are more or less restricted and in no sense comparable in scope at least to those of nationwide reciprocity.

At the present time, there is a growing interest in the development of a national dental examining board, not only because of the values accruing to the individual practitioner thereby but also because of the potential of such an organization in promoting the importance and usefulness of dentistry.

Since its organization at Niagara Falls, N. Y., in 1883, the National Association of Dental Examiners has given earnest attention to the problems of reciprocity. Its attitude and activities in solving this question have been and are now not merely passive in character. As reflected from the pages of its annual printed proceedings, a sincerity of purpose is revealed and a quality of action in the solution of

this perplexing problem which is not surpassed by any other of the important activities of that organization.

The "Bulletin on Dental Education by the Carnegie Foundation for the Advancement of Teaching" has this to say in relation to the National Association of Dental Examiners (page 35, Bulletin 19):

"This voluntary association of the state boards, which holds annual meetings and regularly publishes its *Proceedings,* has been one of the most important factors in the improvement of the status and quality of dentistry in the United States."

It is, or should be, admitted that certain joint relationships between the professional (American Dental Association), the educational (American Association of Dental Schools) and the civic, legal (National Association of Dental Examiners) influences of dentistry are indispensable to progress and to the wholesome growth of the quality of health service that dentistry may offer. Plainly, the three national bodies are the tripod upon which the future of dentistry rests. These three parent bodies have recognized and subscribed heretofore to certain organizational and governmental principles which in no way have interfered with the inherent and inalienable rights of either organization in their joint relationships and activities.

It was agreed that these rights should be carefully guarded and wisely exercised as otherwise the activities of the tripartite organization might be hampered, results weakened and individual and united opportunities and obligations lost sight of or neglected. It logically follows that the usefulness of any single unit in the agreement might be impaired and its identity lost through the surrender of these rights.

It is because the National Association of Dental Examiners feels that its rights would be usurped through transference to the American Dental Association of the privilege to appoint representatives of the examiners association to the National Dental Examining Board that the National Association of Dental Examiners never officially recognized the National Dental Examining Board as created by the Board of Trustees and the House of Delegates of the American Dental Association, at Minneapolis, in 1928, and officially rejected this plan, in Washington, in 1929, as unworkable and not equitable.

Mindful of the agreement alluded to by the three major bodies in dentistry, and conscious of the splendid work done by the Dental Educational Council of America, which was organized under the agreement referred to, the National Association of Dental Examiners realizes fully that joint relationships, opportunities and obligations cannot be met properly when one agency in the tripartite agreement has more power than any other, particularly in the selection of all representatives in the tripartite organizations. There should be no centralization of power in any of the activities of the tripartite organization, but rather an equal distribution. Some argue, but not justly, that because one organization would furnish the funds for the tripartite agency, it should have the appointive power for the three parent bodies to the single unit. The National Association of Dental Examiners feels that furnishing funds should not carry with it centralization of power, and cites the extent and quality of the work of the Dental Educational Council of America to prove this contention. Funds for the maintenance of the Dental Educational Council of America are furnished by the Ameri-

can Dental Association, but each organization appoints its own representatives.

After many conferences extending over a period of years, an agreement was reached by the National Association of Dental Examiners, the American Dental Association and the American Association of Dental Schools to create a national dental examining board with five representatives from each of the above named organizations and an additional representative from the Army, the Navy and the United States Public Health Service, respectively.

It was understood that each organization should appoint its own members and that the representatives to the National Board of Dental Examiners from the American Dental Association should be neither members of a dental examining board nor teachers in a dental school. These two fundamental organizational principles must necessarily govern the National Association of Dental Examiners in joint relationships with other organizations in dentistry.

At Minneapolis, in 1928, after the three major bodies in dentistry above mentioned had appointed their five representatives in the agreed plan of a National Board of Dental Examiners and after the National Association of Dental Examiners had adjourned *sine die,* the accepted plan was abrogated without comment by the Trustees of the American Dental Association. They offered another plan to finance the project and to create a board with five representatives from each of the major organizations referred to and one from the Army, the Navy and the U. S. Public Service. The resolution creating this board stipulated that the appointive power should be vested in the Board of Trustees of the American Dental Association, and it is to this phase of organization chiefly that the National Association of Dental Examiners objects.

The following resolution was passed by the House of Delegates of the American Dental Association, at Minneapolis, in the closing minutes of the last session of that body:

> *Resolved:* That the House of Delegates recommend that the Board of Trustees name as nominees for Group I and II, one or more men whose names are presented to the Board of Trustees by the National Association of Dental Examiners or the American Association of Dental Schools.
>
> *Resolved:* That if the names presented to the Board of Trustees are not satisfactory the Board of Trustees can request the respective bodies for more names."

Since the appointive power in joint relationships was taken away by this action, the National Association of Dental Examiners has refused to endorse a national dental examining board as so organized.

While the National Association of Dental Examiners had appointed five men to represent it under a plan whereby each organization appointed its own representatives, and while these men have conferred with the organization as created by the Board of Trustees of the A. D. A., at no time have they officially represented the N. A. D. E., because that organization has never ratified the plan of organization as set forth by the A. D. A.

It is difficult to understand how a national board of dental examiners can function without the legal status furnished by the N. A. D. E. While the N. A. D. E. has no desire to appear autocratic or even to act in that way, it cannot be a part of an organization in which its representatives are not appointed by its own body, because usurpation of its rights and privileges would be involved by such an agreement. Then, too, a national dental examining board with

representatives from the N. A. D. E., not appointed by the N. A. D. E., would have no legal status and its actions would be vitiated and made futile thereby. The strategic position the N. A. D. E. holds in the organization and activities of a National Board of Dental Examiners is unique, for obviously such a board cannot function legally without the support of the N. A. D. E.

The legal support which association with the N. A. D. A. offers in tripartite relationships was very forcefully brought to the attention of the profession, the teachers and the Examiners' Association by the Surgeon General's Office, during the War. It was because of the legal status given the Dental Educational Council of America through representation from the N. A. D. E. that the Surgeon General selected it as the authoritative body in dental education. Obviously, this organization principle clearly applies in the organization and activities of a national board of dental examiners.

Summarizing the facts as we see them, at Minneapolis the Trustees dismissed without comment the plan developed by the American Dental Association, the American Association of Dental Schools and the National Association of Dental Examiners, although the plan had been agreed to as the best the committee could work out. The House of Delegates of the American Dental Association adopted a new plan set forth by the Board of Trustees of that organization, and the American Dental Association proceeded to function under this plan without ratification of the plan by either of the other interested parent bodies.

Conscious of the importance and usefulness of a National Board of Dental Examiners in Washington, the National Association of Dental Examiners presented a resolution to the Board of Trustees which set forth one of the important items in the creation of a national board of dental examiners; namely, that the appointive power be vested in the bodies interested. The resolution reads as follows:

Resolved: That the National Association of Dental Examiners will ratify the present plan of organization of the National Board of Dental Examiners provided (1) the three parent bodies, the American Dental Association, the National Association of Dental Examiners and the American Association of Dental Schools, have equal representation thereon; and (2) the appointive power shall be left solely to the parent organizations in naming their representatives.

This resolution has the unanimous approval of the American Association of Dental Schools and is so recorded in its minutes.

Irrespective of the wishes of the N. A. D. E. and the A. A. D. S., as outlined in the foregoing resolution, the Board of Trustees submitted the examiners' request to the House of Delegates but recommended that the present plan, which is the organization as set up, be continued.

The House of Delegates laid the matter on the table for further information. As a result of the failure of the Board of Trustees and the House of Delegates to recognize the wishes of the N. A. D. E., that body cannot endorse the plan proposed by the Board of Trustees of the A. D. A., since the inherent and inalienable rights of the N. A. D. E. and the A. A. D. S. have not been given consideration.

FRACTURED CENTRAL INCISOR

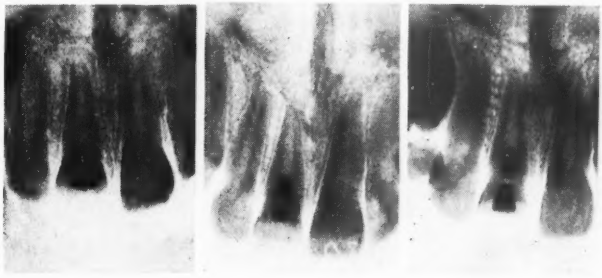
By O. T. RULE, D.D.S., Stamford, Conn.

W.H., a boy, aged 8 years, fell on the ice and broke the left upper central incisor squarely off at the gum line. The pulp was protruding and vital when he came in, Jan. 25, 1926. Under gas anesthesia, the pulp was removed with a barbed broach. A small pellet of cotton saturated with an antiseptic was placed in the canal and covered with a temporary cement.

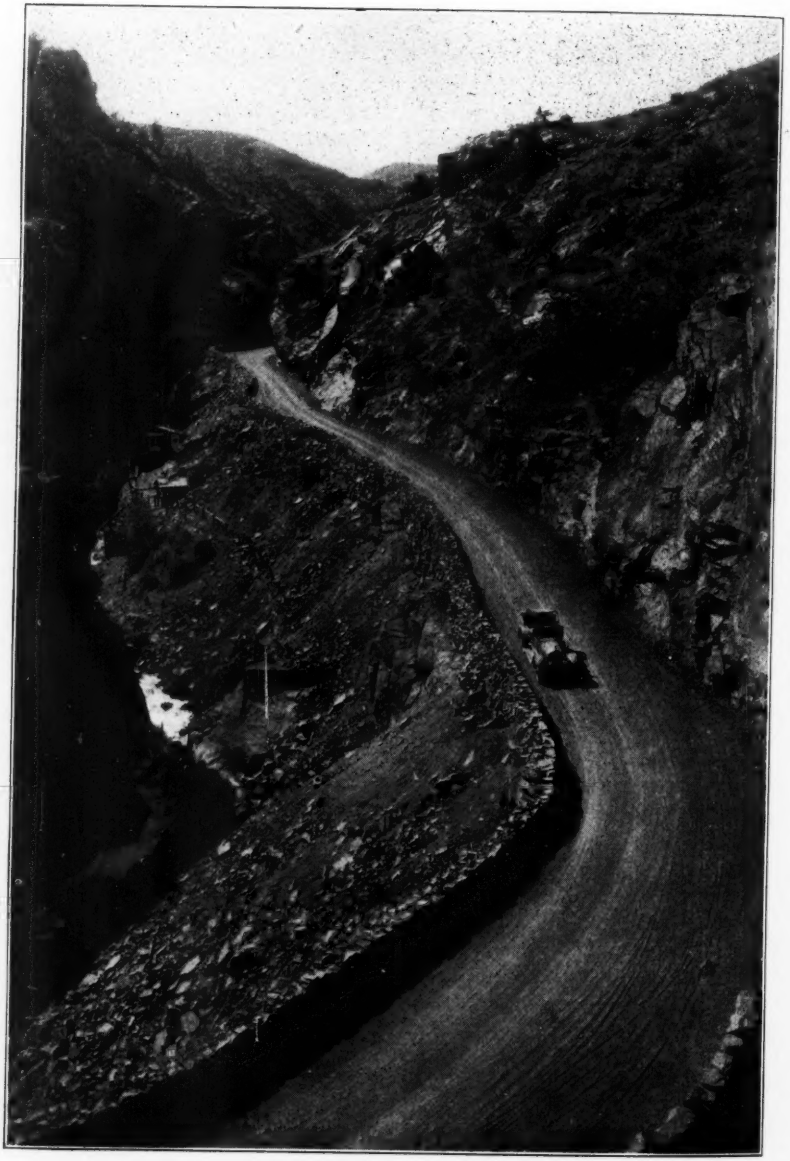
January 27, the treatment was repeated. Copious bleeding followed. There had been no pericementitis. The tooth was treated and sealed as before.

January 30, there was still copious bleeding on removal of the dressing. This time, the canal was partially filled with carbol-eugenol paste, sealed in with a temporary filling. It was then allowed to rest.

February 6, when the carbol-eugenol was removed, as there was still plenty of bleeding the canal was filled and sealed again in the same manner, and developments were awaited. There is no record of renewing the treatment since that date. I am the only one who has ever touched the case, of which the roentgenograms are the really interesting features, as they show complete calcification of the apical portion of the root, after the pulp had been removed from the rest of the canal. The film taken Jan. 25, 1926, shows the incomplete calcification of both central and lateral incisors. The film taken Feb. 25, 1928, shows that calcification had gone along uniformly in the pulpless tooth and its neighbors. The film that was taken Jan. 30, 1930, shows further, and I believe complete, calcification. I am of the opinion that the pulp canal has normal pulp tissue in it. I do not recall hearing or reading of a similar case. It is my intention to remove the temporary filling, put in a smaller plug of red copper cement and make a banded crown with a hollow post for ease of entering the canal if future occasion may require it.



Left: Appearance of central and lateral incisors; showing incomplete calcification (Jan. 25, 1926). Center: Appearance, Feb. 25, 1928; showing that calcification has gone along uniformly in the pulpless tooth and its neighbors. Right: Further, and probably complete calcification (Jan. 30, 1930).



Ute Pass, Colorado

MEMBERS OF THE HOUSE OF DELEGATES 1930

DELEGATES AND ALTERNATES*

ALABAMA

(Members, 312; Delegates, 3)

Delegates

J. A. Blue, Empire Bldg., Birmingham
Olin Kirkland, Shepherd Bldg., Montgomery

Alternates

H. Clay Hassell, 616 22nd Ave., Tuscaloosa
Farrar M. McCrummen, 1st Nat. Bk. Bldg., Birmingham

ARIZONA

(Members, 71; Delegates, 1)

Delegate

H. H. Braxton, Heard Bldg., Phoenix

Alternate

Arch G. Fee, 1024 East 7th St., Tucson

ARKANSAS

(Members, 143; Delegates, 2)

Delegates

J. D. Jordan, Boyle Bldg., Little Rock
Rowe Smith, State Nat. Bk. Bldg., Texarkana

Alternates

A. W. Hudson, Prescott
H. S. Neel, Stuttgart

ARMY DENTAL CORPS

(Members, 150; Delegates, 1)

Delegate

William A. Squires, D. C., Fitzsimons General Hospital, Denver, Colo.

Alternate

Terry P. Bull, D. C., Fort Francis E. Warren, Wyoming

CALIFORNIA STATE

(Members, 1,146; Delegates, 7)

Delegates

Roy A. Green, Medico-Dental Bldg., Sacramento
John E. Gurley, 350 Post St., San Francisco
Vernon L. Hunt, Minor Theater Bldg., Arcata
Arthur R. McDowell, 344 14th St., San Francisco
Guy S. Millberry, 1st and Parnassus Aves., San Francisco
Wilfred H. Robinson, American Bk. Bldg., Oakland
Max Wassman, Jr., 323 Geary St., San Francisco

Alternates

Thomas H. Forde, 291 Geary St., San Francisco
James A. Graham, 209 Post St., San Francisco
Louis Graham, 450 Sutter St., San Francisco
Edward J. Howard, 350 Post St., San Francisco
John E. Kennedy, California State Life Building, Sacramento
B. C. Kingsbury, 870 Market St., San Francisco
Jack Werner, 344 14th St., San Francisco

CALIFORNIA—SOUTHERN

(Members, 1,087; Delegates, 6)

Delegates

Frank G. Staley, Roosevelt Bldg., Los Angeles
John P. Buckley, Taft Bldg., Hollywood
Lewis E. Ford, 16th and Los Angeles Sts., Los Angeles
E. Ray Brownson, Roosevelt Bldg., Los Angeles
J. Franklyn Cook, 511 S. Bonnie Brae, Los Angeles
E. Leslie Eames, Auditorium Bldg., Los Angeles

Alternates

J. E. Riley, Ehlen & Grote Bldg., Orange
H. S. Duff, 1525 State St., Santa Barbara
Henry C. Peisch, Citizens Bk. Bldg., Pasadena
J. Elton Lang, Roosevelt Bldg., Los Angeles
M. M. House, 1001 Floral Drive, Whittier
Harry P. Emeis, Medico-Dental Bldg., San Diego

COLORADO

(Members, 356; Delegates, 3)

Delegates

Z. T. Roberts, Metropolitan Bldg., Denver
R. A. Adams, Metropolitan Bldg., Denver
F. W. Stoddard, Masonic Temple, Loveland

Alternates

A. W. Starbuck, Republic Bldg., Denver
Bertram H. Downs, Exchange Nat. Bk. Bldg., Colorado Springs
G. E. Mallett, Republic Bldg., Denver

CONNECTICUT

(Members, 629; Delegates, 4)

Delegates

Albert E. Cary, 904 Main St., Hartford
C. E. Peterson, 34 Park Place, Rockville
Morton J. Loeb, 66 Trumbull St., New Haven
Stanley E. Armstrong, 129 Whitney Ave., New Haven

Alternates

J. Francis Keeley, 1115 Main St., Bridgeport
J. Otis Miner, 48 Main St., New London
Robert P. B. Hughes, 902 Main St., Hartford
Joseph W. Borchardt, 108 Bank St., Waterbury

DELAWARE

(Members, 44; Delegates, 1)

Delegate

Warren S. P. Combs, Middletown

Alternate

Clyde A. Nelson, Milford

DISTRICT OF COLUMBIA

(Members, 332; Delegates, 3)

Delegates

Mark F. Finley, 1928 I St., N. W., Washington
Henry A. Swanson, The LaSalle Apts., Washington
Sterling V. Mead, 1149 16th St., N. W., Washington

Alternates

W. M. Simkins, 720 Woodard Bldg., Washington
Charles D. Cole, Columbia Medical Bldg., Washington
A. D. Weakley, 1029 Vermont Ave., Washington

FLORIDA

(Members, 311; Delegates, 3)

Delegates

George M. Shields, Congress Bldg., Miami
F. M. York, Hall Bldg., St. Petersburg
C. C. Stewart, Hall Bldg., St. Petersburg

Alternates

C. J. Caraballo, Stovall Bldg., Tampa
C. J. Masters, St. James Bldg., Jacksonville
J. P. Getzen, Marble Arcade, Lakeland

*Compiled, May 31, 1930

IDAHO

(Members, 78; Delegates, 1)

Delegate

C. A. Philpott, 313 Overland Bldg., Boise

Alternate

R. J. Cruse, Pocatello

ILLINOIS

(Members, 3,418; Delegates, 18)

Delegates

E. L. Burroughs, Edwardville
E. D. Coolidge, 25 E. Washington St., Chicago
A. B. Patterson, Morris Bldg., Joliet
R. H. Daniels, Lehmann Bldg., Peoria
George N. West, 30 N. Michigan Ave., Chicago
L. L. Davis, 58 E. Washington St., Chicago
J. Roy Blayney, 2209 Rosemont Ave., Chicago
W. Ira Williams, 122 S. Michigan Ave., Chicago
W. I. McNeil, Mallers Bldg., Chicago
D. M. Gallie, Jr., 25 E. Washington St., Chicago
F. B. Clemmer, 1971 W. 111th St., Chicago
E. C. Pendleton, 916 Galt Ave., Chicago
C. F. B. Stowell, 25 E. Washington St., Chicago
Hugo Franz, 25 E. Washington St., Chicago
T. L. Grisamore, 29 E. Madison St., Chicago
B. H. Sherrard, Central Trust Bldg., Rock Island
O. H. Seifert, Myers Bldg., Springfield
F. A. Weld, Rockford National Bank Bldg., Rockford

Alternates

W. A. McKee, Benton
J. W. Smith, 102A East Main St., Belleville
P. B. D. Idler, 55 E. Washington St., Chicago
T. P. Donelan, Illinois Mine Workers Bldg., Springfield
F. E. Ebert, Cooperative Bldg., Champaign
E. W. Elliot, 55 E. Washington St., Chicago
E. E. Graham, 58 E. Washington St., Chicago
Z. W. Moss, Dixon
B. O. Sippy, 30 N. Michigan Ave., Chicago
R. E. Libberton, 7359 Cottage Grove Ave., Chicago
W. F. Schmeckebier, 1620 Orrington Ave., Evanston
E. A. Prugh, 104 N. Oak Park Ave., Oak Park
E. Byron Kelly, 55 E. Washington St., Chicago
H. W. Oppice, 1002 Wilson Ave., Chicago
H. W. Freeman, Grant Park
B. B. Beatty, Ferguson Bldg., Springfield
L. H. Dodd, Standard Life Bldg., Decatur
William Mullin, 185 N. Wabash Ave., Chicago

INDIANA

(Members, 672; Delegates, 4)

Delegates

W. R. Meeker, Wallace Theater Bldg., Peru
A. R. Ross, Murdock Block, Lafayette
C. R. Jackson, Hume Mansur Bldg., Indianapolis
C. E. Redmon, 13½ West Third St., Peru

Alternates

P. H. Chadwick, 130 East Second St., Rushville
A. L. Voiers, Redmens Bldg., Jeffersonville
R. N. Douglas, 506 S. Second St., Elkhart
F. Wade LaRue, Medical Arts Bldg., Indianapolis

IOWA

(Members, 893; Delegates, 5)

Delegates

John V. Conzett, 116 W. 13th St., Dubuque
J. G. Hildebrand, Waterloo
Fred H. Waters, Ames
C. V. Watts, K. P. Bldg., Des Moines
John Scholten, American Trust Bldg., Cedar Rapids

Alternates

H. J. Altfillisch, Bank & Insurance Bldg., Dubuque
H. D. Coy, Hamburg
W. J. Charters, Hippee Bldg., Des Moines
L. M. Fitzgerald, 205 Bank & Insurance Bldg., Dubuque
A. A. Plagman, American Bank Bldg., Davenport

KANSAS

(Members, 453; Delegates, 3)

Delegates

A. J. Buff, Mills Bldg., Topeka
Homer B. Robison, Rorabaugh-Wiley Bldg., Hutchinson
Fred A. Richmond, Federal Reserve Life Bldg., Kansas City

Alternates

George E. Burket, Kingman
George A. Crise, Manhattan
G. E. Tilton, 709 Schweiter St., Wichita

KENTUCKY

(Members, 436; Delegates, 3)

Delegates

R. P. Thomas, Heyburn Bldg., Louisville
J. T. O'Rourke, 129 E. Broadway, Louisville
E. C. Hume, Francis Bldg., Louisville

Alternates

Joe W. Jones, Dawson Springs
C. W. Meguiar, Franklin
W. F. Walz, Fayette Bank Bldg., Lexington

LOUISIANA

(Members, 204; Delegates, 2)

Delegates

Leo J. Schoeny, Donaldsonville
T. S. Bennett, Weber Bldg., Lake Charles

Alternates

Walter Leabo, Medical Arts Bldg., Shreveport
Sidney L. Tibiler, Canal Bk. Bldg., New Orleans

MAINE

(Members, 163; Delegates, 2)

Delegates

Henry A. Kelley, 655 Congress St., Portland
Albert Johnson, 32 Deering St., Portland

Alternates

Fred E. Maxfield, 31 Central St., Bangor
Archer Jordan, 53 Court St., Auburn

MARYLAND

(Members, 367; Delegates, 3)

Delegates

J. Ben Robinson, Medical Arts Bldg., Baltimore
Burt B. Ide, Medical Arts Bldg., Baltimore
H. Hayward Streett, 819 Park Ave., Baltimore

Alternates

J. H. Ferguson, Medical Arts Bldg., Baltimore
A. G. Twigg, 99 Baltimore Ave., Cumberland
Harry B. McCarthy, Medical Arts Bldg., Baltimore

MASSACHUSETTS

(Members, 1,474; Delegates, 8)

Delegates

Frank A. Delabarre, 520 Beacon St., Boston
Philip E. Adams, 236 Newbury St., Boston
William H. Gilpatric, 358 Commonwealth Ave., Boston
Edward F. Sullivan, 520 Beacon St., Boston
F. G. Allen, 358 Commonwealth Ave., Boston
F. G. Rollins, 358 Commonwealth Ave., Boston
Walter E. Briggs, Bates Bldg., Attleboro
Edwin J. Morse, 77 Newbury St., Boston
Amos I. Hadley, 125 Marlborough St., Boston

Alternates

John W. Cooke, 60 Charlesgate W., Boston
Maurice E. Peters, 60 Charlesgate, Boston
L. M. S. Miner, 363 Marlborough St., Boston
William Rice, 416 Huntington Ave., Boston
Benjamin Tishler, 358 Commonwealth Ave., Boston
Leon A. Storz, 3 Tuckerman St., Worcester
F. H. Dean, 311 Main St., Worcester

MICHIGAN

(Members, 175; Delegates, 7)

Delegates

E. G. Robbins, Robbins Block, Ishpeming
R. E. Patterson, Stroh Bldg., Detroit
P. J. O'Reilly, 4622 Grand River Ave., Detroit
M. L. Ward, 1308 Cambridge Road, Ann Arbor
M. W. Prince, 7634 Dexter Blvd., Detroit
U. G. Rickert, 726 S. State St., Ann Arbor
W. F. Northrup, Stroh Bldg., Detroit

Alternates

Ward Moore, Grand Rapids Nat. Bk. Bldg., Grand Rapids
C. J. Lyons, 1004 Oakland Ave., Ann Arbor
Charles Lane, Eaton Tower, Detroit
C. T. Ferries, Houghton
J. O. Goodsell, Second Nat. Bk. Bldg., Saginaw
W. W. Gibson, Medical Arts Bldg., Grand Rapids
W. E. Bailey, 419 S. Capitol Ave., Lansing

MINNESOTA

(Members, 1,309; Delegates, 8)

Delegates

R. O. Green, Lowry Medical Arts Bldg., St. Paul
Henry W. Ernst, Lowry Medical Arts Bldg., St. Paul
H. C. Wittich, Lowry Medical Arts Bldg., St. Paul
W. A. Grey, Lowry Medical Arts Bldg., St. Paul
T. B. Hartzell, Physicians & Surgeons Bldg., Minneapolis
George M. Damon, LaSalle Bldg., Minneapolis
Benjamin Sandy, Medical Arts Bldg., Minneapolis

Alternates

Vern D. Irwin, Fidelity Bldg., Duluth
C. C. Sparrow, LaSalle Bldg., Minneapolis
Boyd S. Gardner, Rochester
H. A. Munns, Medical Arts Bldg., Minneapolis
Carl W. Waldron, LaSalle Bldg., Minneapolis
H. A. Maves, Donaldson Bldg., Minneapolis
Clayton A. Swanson, Medical Arts Bldg., Minneapolis

MISSISSIPPI

(Members, 200; Delegates, 2)

Delegates

W. R. Wright, Jackson
Rush P. Abbott, West Point

Alternates

R. S. Neyland, Jackson
W. C. Dennis, Jackson

MISSOURI

(Members, 955; Delegates, 6)

Delegates

W. M. Bartlett, Wall Bldg., St. Louis
R. J. Rinehart, 1024 E. 10th St., Kansas City
J. P. Harper, 3554 Caroline Ave., St. Louis
E. H. Keys, University Club Bldg., St. Louis
D. D. Campbell, Shukert Bldg., Kansas City
A. J. Thompson, Shukert Bldg., Kansas City

Alternates

E. P. Brody, 7239 Northmoor, Clayton
R. W. Edwards, 17 E. 65th St., Kansas City
H. C. Pollock, 4482 Washington Blvd., St. Louis
O. F. Freitag, 3420 Arsenal St., St. Louis
J. J. Barnett, Frisco Bldg., Joplin
E. E. Haverstick, 346 N. Boyle Ave., St. Louis

MONTANA

(Members, 137; Delegates, 2)

Delegates

D. H. McCauley, Laurel
B. C. Lee, Hamilton

Alternates

F. W. Adams, Billings
R. C. Purdum, Bozeman

NAVY DENTAL CORPS

(Members, 122; Delegates, 1)

Delegate

Paul G. White, Dental Division, Bureau of Medicine and Surgery, Navy Dept., Washington, D. C.

Alternate

William L. Darnall, Naval Hospital, San Diego, Calif.

NEBRASKA

(Members, 520; Delegates, 4)

Delegates

E. A. Thomas, Hastings
R. R. Ralston, Medical Arts Bldg., Omaha
G. A. Grubb, Dental College, Lincoln
E. H. Bruening, City Nat. Bank Bldg., Omaha

Alternates

H. E. King, Peters Trust Bldg., Omaha
F. F. Whitcomb, Medical Arts Bldg., Omaha
C. E. Brown, Security Mutual Bldg., Lincoln
F. A. Pierson, Federal Trust Bldg., Lincoln

NEW JERSEY

(Members, 1,170; Delegates, 7)

Delegates

Edward L. Wharton, 50 James St., Newark
John S. Owens, 109 N. 5th St., Camden
Kenneth C. Pruden, 44 Church St., Paterson
Richard S. Hopkins, 31 Lincoln Park, Newark
William H. Gelston, 40 N. 30th St., Camden
F. H. Lum, Jr., 151 Main St., Chatham
George H. Grim, 695 Bergen Ave., Jersey City

Alternates

Walton J. Graft, 49 Bleecker St., Newark
Philip L. Schwartz, 49 Bayard St., New Brunswick
George H. Martin, 921 Bergen Ave., Jersey City
E. J. H. Schneider, 806 Clinton Ave., Newark
Eugene W. Roberts, 627 Haddon Ave., Collingswood
H. Leo Romine, 31 South St., Morristown
Walter A. Schilke, 44 East Palisade Ave., Englewood

NEW MEXICO

(Members, 57; Delegates, 1)

Delegate

M. J. Moran, Deming

Alternate

E. G. Brentari, Belen

NEW YORK

(Members, 3,781; Delegates, 20)

Delegates

Theodor Blum, 101 E. 79th St., New York City
Martin Dewey, 17 Park Ave., New York City
J. T. Hanks, 17 Park Ave., New York City
J. L. Peters, 133 W. 72nd St., New York City
Alfred Walker, 100 W. 59th St., New York City
F. R. Adams, 8 W. 40th St., New York City
C. W. McNeely, 1 Nevins St., Brooklyn
Ellison Hillyer, 1143 Dean St., Brooklyn
J. A. Burgun, 184 Joralemon St., Brooklyn
D. E. Hurley, 80 W. 4th St., Troy
H. R. Mead, 6 Eagle St., Schenectady
A. R. Cooke, University Bldg., Syracuse
E. R. Webb, State Tower Bldg., Syracuse
C. S. Fowler, Watertown
H. J. Burkhart, Box 35, E. Ave. P. O., Rochester
E. G. Link, Cutler Bldg., Rochester
G. G. Pritchard, 468 Delaware Ave., Buffalo
P. W. Zillman, 29 Walden Ave., Buffalo
E. F. Mimmack, 266 Bryant St., Buffalo
H. A. Pullen, 675 Delaware Ave., Buffalo

Alternates

O. J. Chase, 140 W. 57th St., New York City
A. S. Litten, 230 Central Park W., New York City
E. F. Ros, 51 E. 42nd St., New York City
W. A. Squires, 115 Broadway, New York City
R. W. Tench, 116 Central Park S., New York City
R. Ottolengui, 80 W. 40th St., New York City
F. A. Gough, 184 Joralemon St., Brooklyn
John H. Carter, 145 Mohawk St., Cohoes
A. S. Moore, 708 Union St., Schenectady
W. L. MacDonnell, Mayro Bldg., Utica
C. B. Beach, S. A. & K. Bldg., Syracuse
C. L. Tague, 14 E. Bridge St., Oswego
Walter R. O'Neil, 747 W. Main St., Rochester
Gerald G. Burns, Professional Bldg., Rochester
C. E. Flagg, 158 Anderson Pl., Buffalo
L. Lee Mulcahy, Batavia
Robert L. Murray, 761 Elmwood Ave., Buffalo
Guy M. Fiero, 40 North St., Buffalo
A. W. Twiggar, 168 Main St., Ossining
H. P. Massoth, 421 Huguenot St., New Rochelle

NORTH CAROLINA

(Members, 367; Delegates, 3)

Delegates

Paul E. Jones, Farmville
E. B. Howle, 15 W. Hargett St., Raleigh
John H. Wheeler, 305 Banner Bldg., Greensboro

NORTH DAKOTA

(Members, 157; Delegates, 2)

Delegates

Albert Hallenberg, N. Broadway, Fargo
C. E. Johnson, Valley City

Alternates

F. J. Hartl, Arcade Blk., Minot
H. C. Cooper, Abercrombie

OHIO

(Members, 1,870; Delegates, 10)

Delegates

D. P. Snyder, 137 E. State St., Columbus
H. E. Germann, Gwynne Bldg., Cincinnati
C. W. Mills, Chillicothe
Harry Cope, 327 E. State St., Columbus
T. I. Way, Doctors Bldg., Cincinnati
F. M. Casto, Keith Bldg., Cleveland
E. C. Mills, 255 E. Broad St., Columbus
J. V. Gentilly, Rose Bldg., Cleveland
E. S. Braithwaite, Union Bldg., Cleveland
G. C. Nixon, Mahoning Bk. Bldg., Youngstown

Alternates

C. W. Strosnider, 683 E. Broad St., Columbus
J. H. Chessrown, Mahoning Bk. Bldg., Youngstown
J. J. Welker, Ohio Bldg., Toledo
O. B. Kneisly, American Bldg., Dayton
C. Stanley Smith, Neave Bldg., Cincinnati
P. J. Aufderheide, Rose Bldg., Cleveland
J. K. Douglas, Bliss Bldg., Sandusky
W. H. Hayden, 228 Lincoln Ave., Youngstown
J. W. Hartshorn, Nicholas Bldg., Toledo
H. J. Neidhamer, Gwynne Bldg., Cincinnati

OKLAHOMA

(Members, 398; Delegates, 3)

Delegates

A. E. Bonnell, Surety Bldg., Muskogee
C. R. Lawrence, Enid
F. J. Reichmann, Medical Arts Bldg., Oklahoma City

Alternates

A. F. Sebert, Clinton
T. W. Sorrels, Medical Arts Bldg., Oklahoma City
C. L. White, Medical Arts Bldg., Oklahoma City

OREGON

(Members, 276; Delegates, 2)

Delegates

H. C. Miller, East 6th and Oregon Sts., Portland
H. C. Fixott, Medical-Dental Bldg., Portland
C. H. Wälrath, Selling Bldg., Portland

Alternates

H. W. Titus, Miner Bldg., Eugene
W. B. Lee, Tiffany Bldg., Eugene
J. A. Harper, Corvallis

PENNSYLVANIA

(Members, 2,337; Delegates, 13)

Delegates

Z. T. Jackaway, 1506 E. Susquehanna Ave., Philadelphia
H. E. Friesell, Schenley Apts., Pittsburgh
A. C. Young, 121 University Place, Pittsburgh
J. A. Brady, 2108 N. Broad St., Philadelphia
C. W. Hagan, 1011 Macon Ave., Swissvale
G. A. Coleman, 15th and Locust Sts., Philadelphia
T. A. Hogan, Jenkins Arcade, Pittsburgh
J. H. Corcoran, Scranton Life Bldg., Scranton
H. M. Kirkpatrick, Payne Shoemaker Bldg., Harrisburg
F. C. Friesell, Schenley Apts., Pittsburgh
L. A. Halpern, 5401 Lebanon Ave., Philadelphia
W. A. McCready, Highland Bldg., Pittsburgh
P. V. McParland, Highland Bldg., Pittsburgh

Alternates

R. E. Black, Huntingdon
E. H. Smith, 1416 Surray Lane, Philadelphia
W. E. Lotz, Tyrone
W. E. Mendell, 405 E. Ohio St., Pittsburgh
E. E. Henry, 1916 E. Dauphin St., Philadelphia
H. C. Metz, Highland Bldg., Pittsburgh
J. C. Nugent, Central Trust Bldg., Altoona
L. M. Ennis, 40th and Spruce Sts., Philadelphia
A. I. Wise, Schmidt Bldg., Pittsburgh
G. W. Peiffer, Sewickley
W. H. Fordham, Medical Arts Bldg., Scranton
F. D. Miller, 1122 12th Ave., Altoona
D. A. Swift, Medical Arts Bldg., Scranton

PORTO RICO

(Members, 24; Delegates, 1)

Delegate

J. Fernandez Carballo, Box 750, San Juan

Alternate

G. E. Hernandez Mora, Box 1514, San Juan

PUBLIC HEALTH SERVICE

(Members, 30; Delegates, 1)

Delegate

C. T. Messner, U. S. Public Health Service, Washington, D. C.

Alternate

R. L. Robinson, Dental Surgeon, U. S. P. H. S., U. S. Marine Hospital, Buffalo, New York

RHODE ISLAND

(Members, 154; Delegates, 2)

Delegates

Frank H. Ackrill, 236 Westminster St., Providence
Frank P. Duffy, West Warwick

Alternates

Charles J. Smith, 146 Westminster St., Providence
Albert L. Midgley, Union Trust Bldg., Providence

SOUTH DAKOTA

(Members, 154; Delegates, 2)

Delegates

E. W. Elmen, Citizens Nat. Bank Bldg., Sioux Falls
John W. Smoots, Spearfish

Alternates

Harry Y. Mann, Mobridge
W. W. Price, Centerville

TENNESSEE

(Members, 328; Delegates, 3)

Delegates

George L. Powers, Sterick Bldg., Memphis
F. W. Meacham, Hamilton Nat. Bk. Bldg., Chattanooga
J. Baird Jones, Murfreesboro

Alternates

James W. Winn, Lambuth Bldg., Nashville
D. P. Houston, Hamilton Nat. Bk. Bldg., Chattanooga
Roy O. Elam, Medical Arts Bldg., Nashville

TEXAS

(Members, 531; Delegates, 4)

Delegates

H. W. Hoffer, Kaufman
G. P. Robertson, Moore Bldg., San Antonio
J. M. Murphy, Temple
G. H. Mengel, Roberts Banner Bldg., El Paso

Alternates

R. E. Lee, Edna
W. A. Grouws, Medical Arts Bldg., Dallas
R. D. Griffis, Paris
G. W. Tinslar, Medical Arts Bldg., Fort Worth

UTAH

(Members, 159; Delegates, 2)

Delegates

A. C. Wherry, Deseret Bk. Bldg., Salt Lake City
E. E. Greenwell, 1st Nat. Bk. Bldg., Ogden

Alternates

M. W. Merrill, Provo
N. E. Munk, Logan

VERMONT

(Members, 97; Delegates, 1)

Delegate

H. L. Averill, Middlebury

VIRGINIA

(Members, 390; Delegates, 3)

Delegates

H. Wood Campbell, Suffolk
R. F. Simmons, Medical Arts Bldg., Norfolk
Harry Bear, Professional Bldg., Richmond

Alternates

W. N. Hodgkin, Warrenton
S. D. Kent, Arcade Bldg., Danville
R. H. Phipps, Marion

WASHINGTON

(Members, 682; Delegates, 4)

Delegates

George D. Williams, Paulsen Bldg., Spokane
Frank W. Hergert, Medical Bldg., Seattle
A. L. Martin, Medical and Dental Bldg., Seattle
Roy F. West, Medical Bldg., Seattle

Alternates

N. E. Davis, Medical and Dental Bldg., Seattle
H. C. Houck, Medical Bldg., Seattle
George I. Hoffman, Medical and Dental Bldg., Spokane
John J. McCarthy, Washington Bldg., Tacoma

WEST VIRGINIA

(Members, 305; Delegates, 3)

Delegates

W. E. Minghini, Martinsburg
Howard E. Summers, 1st Nat. Bank Bldg., Huntington
Charles M. Malcolm, Charleston

Alternates

S. E. Langfitt, 1st Nat. Bank Bldg., Huntington
N. H. Baker, Kanawha Nat. Bank Bldg., Charleston
C. H. Wilmoth, Glen Jean

WISCONSIN

(Members, 986; Delegates, 6)

Delegates

J. J. Wright, Wells Bldg., Milwaukee
George A. Stratton, 34 Washington Blvd., Oshkosh
M. H. Mortonson, 1st Nat. Bk. Bldg., Milwaukee
T. A. Hardgrove, 104 S. Main St., Fond du Lac
W. I. Macfarlane, Tomahawk
Roy S. Hopkinson, 1st Nat. Bk. Bldg., Milwaukee

Alternates

G. E. Cleophas, Goodwin Blk., Beloit
J. F. Mortell, 1st Nat. Bank Bldg., Oshkosh
R. W. Huegel, 104 King St., Madison
J. H. Kolter, 520 3rd St., Wausau
J. W. Crawford, 1st Wis. Nat. Bank Bldg., Milwaukee
N. E. Uelmen, Wells Bldg., Milwaukee

Little Narrows, South St. Vrains Canyon, Colorado

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C. N. JOHNSON, Editor

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Editorials

PROFESSIONAL ETHICS AS RELATED TO PUBLIC ADVERTISING

Advertising has become an established order of procedure on the part of business enterprises. It is the life current through which flows the sustenance that brings vitality to business, and without which most of our business enterprises would languish.

But advertising has not always been in the past, and in some instances is not today, as salutary as it might be. There is one fundamental requisite in all advertising that is to be eventually effective, and that is that it must be truthful, and this has not always been the case. Advertisers have sometimes not hesitated to misrepresent facts in their desire to further the sales of their products; and misrepresentation is always demoralizing. This is becoming so generally recognized that a sentiment is growing up among advertising agencies themselves tending toward a disposition to frown on misleading statements in advertising literature. If this tendency is

carried to a logical consummation, it will purify advertising and make it more effective.

All of this leads to a consideration of the subject of advertising in professional life. From the time that the professions assumed that particular relationship toward society which placed on them a different obligation from that involved in barter and trade, an obligation whereby the physical, and sometimes the mental and moral, welfare of the people was placed in their keeping, there at once grew up the conviction that to advertise as did the business man was in every way incongruous and not in keeping with the prescribed function of true professional life. The difference between a business man advertising and a professional man advertising is this: the business man is advertising his goods or commodities and there can be no objection to that provided he tells the truth, but the professional man, not having goods for sale, is merely advertising himself, and there is never any propriety in doing that. It is in every way subversive of equity and good taste to vaunt one's own superiority, and that is precisely what every professional man does when he resorts to public advertising.

The peculiar obligation of the professional man led to the establishment of a code of ethics to govern his conduct, and one provision of this code made it unprofessional to resort to public advertising. This has become so ingrained in the professional consciousness that it is no longer a debatable question in professional circles. No man can become a member of a regularly organized professional association if he resorts to public advertising, and no man attempts today to become a member as long as he advertises.

But it is an entirely different matter to educate the public to this point of view. It is true the public is becoming better informed all the while on the inherent incongruity of professional advertising, and yet there are certain interests outside professional life that cannot quite grasp the professional point of view. The publishers of newspapers, for instance, cannot see why advertising is not legitimate in every walk of life. They make their income from advertising and anything that appears to interfere with that income does not appeal to them. This is only natural and quite in keeping with

the universal law of self-preservation; and yet most newspaper publishers are intrinsically honest, and are sincerely desirous of serving the public to its greatest benefit. Therefore, the only thing necessary is for the organized professions to prove to publishers that this kind of advertising is subversive of the best interests of society and even the best interests of the publishers themselves. In the long run, no enterprise, commercial or otherwise, can succeed without having back of it the basis of equity and justice, and as soon as the publishers can be shown that professional advertising is not equitable, they will no longer foster it.

But this must be done by organizations rather than by individuals in order to carry weight. It must be no one man's opinion, but the consensus of a conviction expressed on behalf of long-established professional associations.

To this end, every member of the American Dental Association who approaches a publisher with this matter should be armed with the special provision in our Code of Ethics which covers this point. The section on advertising reads as follows:

ADVERTISING

Sec. 2.—As an inducement to patronage in the practice of dentistry, it is unethical and unprofessional for a dentist to employ, or permit the employment of, letters, handbills, posters, circulars, cards, signs, stereopticon slides, motion pictures, telephone, radio, newspapers or any kind of printed or written publications, or any other device or means for the purpose of

(1) Advertising personal superiority or ability to perform services in a superior manner.

(2) Advertising definite fixed fees, which in the nature of the professional service rendered must be variable.

(3) Advertising statements that might be calculated to deceive or mislead the public.

(4) Advertising under the name of a corporation, company, association, parlor or trade name.

(5) Advertising special methods of practice or peculiar styles or service.

(6) Advertising reports of cases or certificates to the public.

(7) Employing, associating with or making use of advertising solicitors or free publicity press agents.

(8) Guaranteeing or warranting operations.

The reasons for these provisions are so manifest that they can be made readily clear to publishers of papers, and in most instances the publishers will be found

anxious to cooperate with the organized profession to the extent of eliminating all objectionable professional advertising. The question has sometimes arisen as to what recompense to the publishers might be substituted for the loss in eliminating advertising material of this kind, but this has not yet been worked out satisfactorily. Some publishers contend that they are entitled to consideration in a situation such as this and that if organized dentistry requests them to forego the income from professional advertising, organized dentistry should compensate them in some way for their loss. This argument can hardly be considered tenable for the reason that the elimination of the kind of advertising to which organized dentistry objects is manifestly for the public welfare, and the newspapers should at least be willing to sacrifice something for the people's good. In fact, many of them are doing this all the while, and accordingly there are some publishers who cheerfully decline advertisements of this character as soon as they learn wherein they are objectionable.

All men cannot be expected to see things in the same light, but this whole question of advertising is becoming better clarified, and the distinction between advertising in trade and advertising in professional life is all the while assuming a more rational status in the minds of intelligent people. And the more clearly it is understood, the better it will be for all concerned.

HART J. GOSLEE, B.S., D.D.S.

(1871-1930)

Hart J. Goslee was born in St. Joseph, Mo., April 30, 1871; died in Chicago, Ill., May 31, 1930.

Dr. Goslee spent his boyhood days in St. Joseph and Kansas City, Mo., and from the latter place he moved to St. Paul, Minn. While there, he decided to study dentistry and entered the Chicago College of Dental Surgery, from which institution he was graduated in 1895.

He entered practice in Chicago and at once showed an especial aptitude for prosthetic dentistry, particularly in crown and bridge work. This led eventually to a professorship in this department in the institution from which he had graduated, and later to teaching positions outside the state. His success as a teacher and the enthusiasm displayed in his work soon resulted in various contributions to periodical dental literature, and finally to the preparation of a textbook on crown and bridge work which at once became the outstanding work on this subject, and ran into five editions. The first appeared in 1903, the fifth in 1925, and he was contemplating the preparation of a new edition at the time of his death. He was selected as editor of *The Dental Craftsman* at its inception and held this office till his passing.

In dental society work, he was a splendid executive, a good organizer and a helpful participant in the proceedings. As a speaker, he was forceful and polished and never failed to entertain his audience. He was lucid in discussing any subject and never left the floor without having added something of value to the theme under con-

sideration. He will be greatly missed by the organizations with which he was most closely associated.

About two years ago, Dr. Goslee suffered an injury to one of his ankles which never healed, and this finally necessitated the amputation of his leg above the knee. This with subsequent minor operations and the consequent suffering took a heavy toll of his vitality, and he never fully regained his accustomed health.

He was made the recipient of many honors in his profession, all of which were richly deserved. In 1910, Marquette University granted him the degree of bachelor of science. He was made honorary member of the Odontological Society of New York, and various other societies, including one in Norway. He was expresident of the American Institute of Dental Teachers, of the Chicago Dental Society, the Odontographic Society of Chicago and the Illinois State Dental Society. It was at the 1930 meeting of the latter society a few weeks before his death that he displayed the most superb courage in conducting the sessions in a masterly manner in the face of constant suffering and almost utter exhaustion. Through his generalship, this meeting goes down as one of the most successful in the history of the society.

He was a member of the Chicago Athletic Club, and of Delta Sigma Delta fraternity, the first dental Greek letter society organized. He was also a member of St. James Episcopal Church of Chicago.

Besides his widow, Mrs. Edith P. Goslee, he leaves a half brother in California, Mr. L. Owings. Interment was in Rose Hill Cemetery, June 4, and the funeral was largely attended by professional and other friends from Illinois and adjoining states.

To sum up Dr. Goslee's characteristics, the most outstanding quality was that of generosity. An appeal was never made to him in vain, and whether with friend or foe, his leaning was always toward the side of tolerance and forbearance. He sympathized keenly with those in distress and his kindliness of heart was never known to forsake him. He made friends readily, and drew men to him with the subtle bond of unselfishness and spontaneous good will. He has left his impress on our profession not only in his constructive contributions to its archives, but also in the warmth and glow of his lovable personality. And after all, the thing that most counts in life is not so much the towering intellect as it is the loyal heart; and in the sum total of all that goes to magnify our existence and make it worth the while, those qualities mean most which have to do with the affections and the emotions rather than with the wisdom of all the ages.

And in this respect, Hart Goslee stood out supreme as a lover of his fellowmen and as an exemplar of the best there is in bigness of heart and spontaneous good will.

HART J. GOSLEE, B.S., D.D.S., F.A.C.D.
(1871-1930)

BUREAU OF CHEMISTRY

MORE MISBRANDED NOSTRUMS

IN the December, 1929, issue of THE JOURNAL, the A. D. A. Bureau of Chemistry published under the title "The Truth About Patent Medicines" brief abstracts of investigations made elsewhere concerning nostrums, and called attention to the various agencies which are vigilant in exposing those who would exploit the public for their own gain. One of the agencies mentioned was the Food, Drug and Insecticide Administration of the Department of Agriculture. From time to time, the Administration issues Notices of Judgment. These deal with such proprietary medicines as have been found by government officials to be sold under claims that were false, misleading or fraudulent. During the month, there have been issued from this source some Notices of Judgment against pharmaceutic products that were found to be misbranded under the Food and Drugs Act. It should be noted that while these reports were issued in February, 1930, the offenses charged were committed, in many instances, six months or more previously. A number of abstracts of these Notices of Judgment, dealing with pharmaceutic products of interest to dentists are given here:

DAR-LING-OIL

The Hemlock Oil Co., Derry, N. H., shipped on or about Jan. 17, 1929, from New Hampshire into Massachusetts, packages of Dar-Ling-Oil, which the government declared was misbranded. Analysis of samples showed that Dar-Ling-Oil contained camphor, chloroform and volatile oils, including mustard and pine oils. It was alleged in the libel that the curative statements regarding toothache, etc., were false and fraudulent in that the article contained no ingredient or combination of ingredients capable of producing the effects claimed. In June, 1929, judgment of condemnation and forfeiture was entered and the court ordered the product to be destroyed. (Notice of Judgment 16551; issued, Feb. 1, 1930.)

SEDAFEN

The Sedafen Products Co., Springfield, Ohio, in August, 1928, shipped from Ohio to Indiana some packages of Sedafen, which the federal authorities declared were misbranded. Analysis of a sample showed that the product contained acetphenetidin, acetylsalicylic acid and caffein. It was alleged that the following statements were false and misleading: "Safe . . . Harmless, Does Not Affect the Heart . . . Stops Pain without causing any after effects." By reason of these and other quoted false and fraudulent statements, the product should be condemned. The court ordered that the product be destroyed. (Notice of Judgment 16555, issued, February, 1930.)

WAG'S SALVE

About February, 1929, Wag's Chemical Co. (Inc.), Knoxville, Tenn., shipped from Tennessee to Virginia a number of packages of Wag's Salve, which the government alleged were misbranded in violation of the Food and Drugs Act. Analysis of the material showed the presence of volatile oils including methyl salicylate and menthol incorporated in petrolatum. The authorities alleged that the article was misbranded in that the following statements, among others, were false and fraudulent as the article contained no ingredient or combination of ingredients cap-

able of producing in the conditions mentioned the effect claimed, viz.: "Infected Gums, Pyorrhea, bleeding, receding, sore gums . . . Toothache . . . If tooth is decayed, clean it out and pack with Wag's Salve." In June, 1929, the United States Marshal was ordered to destroy the product. (Notice of Judgment 16559, issued, February, 1930.)

SALICON

K. A. Hughes Co. shipped into the State of Maine from Massachusetts a number of packages of Salicon, which the government charged were misbranded. Analysis by the government chemists showed that the article contained acetylsalicylic acid (3.8 grains per tablet), phenolphthalein and calcium and magnesium carbonates. The authorities alleged that Salicon was misbranded in that the following statements were false and misleading: "Does not affect the heart; does not upset the stomach . . . It can be used freely and fearlessly . . . Salicon does not affect the heart . . . Salicon also is a germicide." Misbranding was also alleged in that statements regarding the curative and therapeutic effects were false and fraudulent; among others the following: "For Headache, Earache, Toothache, Backache, Periodic and other Pains . . ." since the product contained no ingredient or combination of ingredients capable of producing the effects claimed. In May, 1929, K. A. Hughes Co. having appeared as claimant, judgment of condemnation and forfeiture was entered and the court ordered that the product be released on payment of cost, and the execution of a bond conditioned in part that the claimant empty the product from the containers into unlabeled boxes or remove entirely and destroy the bottle labels and destroy the labelings, circulars, branding, cartons and all printed matter accompanying or used in connection with the product. (Notice of Judgment 16566, issued, February, 1930.)

NEURO-NERVE POWDERS

The Neuro Chemical Company of West Brighton, N. Y., shipped from New York to Connecticut a quantity of packages of Neuro-Nerve Powders, which the government charged was misbranded. Analysis by chemists in the federal service showed that the powders contained acetylsalicylic acid, acetphenetidin and caffein. The authorities alleged that the article was misbranded in that statements regarding the therapeutic and curative effects of the article were false and fraudulent, viz.: "Neuro-Nerve Powders will give prompt relief in obstinate cases of neuralgia, toothache . . . For the relief of Neuralgia . . . Toothache, Sore Throat, La Grippe, Sciatica and all nerve pains. These powders have a special action upon the nervous system and will remove instantly all nerve pains . . . Toothache—This unpleasant affliction will be radically relieved in from five to ten minutes . . ." in that the article contained no ingredients or combination of ingredients capable of producing the effects claimed. In March, 1929, by consent of the claimant, judgment of condemnation and forfeiture was entered and the court ordered that the product be destroyed. (Notice of Judgment 16574, issued, February, 1930.)

FORESITE DENTAL PREPARATION

FORESITE is another dentifrice brought to the attention of the A. D. A. Bureau of Chemistry. The Foresite Mfg. Co. of Minneapolis claim it to be a "dental preparation" for

Pyorrhea, Trench Mouth, Loose Teeth, Gum Disorders, Bleeding Gums, Halitosis, Whitens Teeth.

A dentist in Minneapolis writes concerning Foresite: "It is so very sharp (gritty) that I am not inclined to think well of it, but my attention was called to it by the fact that some of my child patients have been using it. . . ." (Fig. 1.)

Examination of Foresite showed it to contain approximately 28 per cent pumice. The danger of the daily use of a

dentifrice containing an abrasive such as pumice has already been pointed out in connection with Lavita (THE JOURNAL, January, 1930); not to mention the action when it is used on children's teeth.

It is left to the Foresite Mfg. Co. to explain how pumice may be expected to do all that is claimed for it.

One original package of Foresite Dental Preparation (Foresite Mfg. Co., Minneapolis, U. S. A.) was received for examination.

Fig. 1.—Foresite container (actual size).

Appearing on the package was the following:

Treatment for Pyorrhea, Trench Mouth, Loose Teeth, Gum Disorders, Bleeding Gums, Halitosis, Whitens Teeth.

The package contained 10 gm. (approximately one-third ounce) of a gray white powder, possessing a cinnamon odor. When the powder was examined under the microscope, the presence of material having the optical properties of pumice was indicated.

The presence of pumice was shown by treating the material with hydrochloric acid and filtering. Photomicrographs accompanying this report show the typical

Fig. 2.—Photomicrograph of pumice from Foresite.

structure of silicious grains of which the insoluble material was wholly composed. (Fig. 2.) Quantitative determinations indicate the presence of 27.8 per cent pumice.

No other tests were made.

SOME AGGRAVATED FORMS OF "ASPIRINITIS": A GROWING MENACE THAT SHOULD BE CHECKED

FROM time to time, the A. D. A. Bureau of Chemistry has pointed to the dangers that are apt to occur from the indiscriminate use of "pain relieving" mixtures that are sold under all sorts of fanciful names. The Bureau has also pointed out that by passing out "clinical samples" of these preparations, usually labeled with a catchy name, to their patients, dentists allow themselves to become an advertising medium for the exploiter of such patent medicines. The following is quoted from *Health*, published by the State Board of Health of New Hampshire, and is of interest in this connection:

Recently our attention was directed to a brand of pain reliever now being extensively distributed to drug stores by the Franklin Laboratory, Portland, Maine, under the name of "Phen-Amy-Caps." These are offered for the "relief of pain and discomfort due to headache, toothache, colds, neuralgia, neuritis, rheumatism, muscular aches and periodic pains. Adult dose, one to two capsules with water followed by one capsule every three hours if necessary."

These capsules purport to be composed of amidopyrine 3.5 grains, phenacetin, one grain, caffeine one-half grain, and extract hyoscyamus one-fourth grain—a combination which will be recognized by the physician as being of no small capacity for harm, where indiscriminately used. That these are designed for indiscriminate — indeed, common and promiscuous use, and to be freely handed out to any man, woman or child who may be inconvenienced by an ache or a pain of whatever the cause and regardless of its possible significance, is evidenced by the fact that the preparation is conveniently packed in the well-known aspirin style of small metal "vest-pocket" boxes and is prominently displayed on the top of the drug counter, with a poster tacitly inviting the purchaser of a sundae or newspaper to drop a package into pocket or wrist-bag against the next case of malaise.

It would seem that this is carrying the self-prescribing habit a bit too far for the public health and safety. We have here at least three potent drugs, with none of which the uninformed has any business to trifle. Considered by some authorities to be comparatively free from harmful influences upon the blood, heart and kidneys, others hold that amidopyrine is a stimulant to the heart and blood vessels and that with the condition, for example, of high blood pressure associated with pulmonary tuberculosis, it may occasion spitting of blood. "As an antipyretic its use is slow and continuing, and some observers assert that it is more prone than anti-pyrine and phenacetin to produce excessive sweating and collapse." Phenacetin, taken in excess, produces feebleness of the circulation, and more or less cyanosis. Both of these drugs, of "coal-tar" origin, can cause trouble when used where idiosyncrasies or certain conditions of disease exist, also when employed in excessive quantities. Hyoscyamus (henbane) is an alkaloidal drug similar in its action to belladonna, and in substantial doses is an active poison, deaths having so resulted.

While it is true that the dosages here involved are all small and that comparatively little danger may attend the occasional and proper use of this preparation by the individual in general health, yet there is far too much chance of misuse and of accident to justify the indiscriminate handing out to the laity of this and of similar potent drugs.

BUREAU OF DENTAL HEALTH EDUCATION

ACHIEVEMENTS AND RESULTS IN WEST VIRGINIA OF THE JENKINJONES DENTAL DISPENSARY AND McDOWELL COUNTY DENTAL CLINIC*

By G. T. EPLING, D.D.S., Welch, W. Va.

IN a talk before the American Dental Association in 1927, T. J. Ringle, of Chicago, predicted that within twenty years toothache would be a disgrace. I am going to show you that, according to this statement, we are just twenty years ahead of the times in McDowell County, West Virginia, as our boys and girls now consider it a disgrace to have a toothache. There was a time, not so many years ago, when toothache seemed inevitable. We have now reached the era of preventive dentistry in McDowell County, and no longer have to refer to it as the "coming dentistry."

Just ten years ago, the McDowell County Dental Clinic was established. For those who are not familiar with the development of dental clinics, I will explain how our clinic was established and is maintained. We citizens of McDowell County feel that we have reached the only solution of establishing dental clinics that will reach all of the people in the rural communities and villages as well as those in the city. We have found that children of the wealthier class need dental attention just as much as do the children of the poor. Clinics established by endowment or donations do not reach all the children as does the McDowell County Dental Clinic, which is financed as are the public schools or public improvements, namely, by the tax levy. Children of the rich and poor alike accept the services of our dental clinic just as they do the services of the public schools. The children hesitate to accept the services of a dental clinic financed by any philanthropic method for fear of losing the respect of their schoolmates who are fortunate enough to secure and pay for such services.

The McDowell County Dental Clinic was the outcome of the Jenkinjones Dental Dispensary, an industrial dental dispensary established by Col. James Ellwood Jones, general manager of the Pocahontas Fuel Company, for children of the employes of the various holdings of that big corporation. Colonel Jones is still having this dispensary operated at his coal mines.

The Jenkinjones clinic was watched with a great deal of interest by the medical, dental and educational professions in McDowell County, and the results obtained soon created a sentiment in favor of carrying out the plan on a county-

*Read before the Section on Mouth Hygiene and Preventive Dentistry at the Seventy-First Annual Session of the American Dental Association, Washington, D. C., Oct. 10, 1929.

Fig. 1.—Col. James Ellwood Jones, founder of the Jenkinjones Dental Dispensary, McDowell County, West Virginia.

wide basis. After the operation of this clinic for two years, the taxpayers of the county felt justified, from an economic as well as a humanitarian standpoint, in making the county clinic a reality. Therefore, a bill was drafted to be introduced into the state legislature of 1919. The enabling act passed the legislature, and the people of the county ratified the act by an election held in June of the same year. This authorized the county court, which is the tax-levying body of our county, to lay a levy of 10 cents on every 100 dollars of assessed valuation of property, for the establishment and maintenance of the dental clinic for 1919-1920.

Notwithstanding the fact that McDowell County is a coal mining community and a large percentage of the population move from place to place, giving us a great number of children every year who have never had any dental work, we have been able to do the dental work so thoroughly that, in ten years, the tax has been reduced just one-half, and we are now operating the clinic for a tax of 5 cents on a $100 valuation.

McDowell County Dental Clinic does all dental work thoroughly for all children up to the age of 16 years. No other county has adopted this plan, perhaps because it has not been properly placed before the people, and perhaps, because of the expense. To multiply the amount of money spent in McDowell County by fifty-five, which is the number of counties in West Virginia, suggests a stupendous sum of money. However, the McDowell County Dental Clinic has been in operation continuously for the past ten years, and when our tax levying body

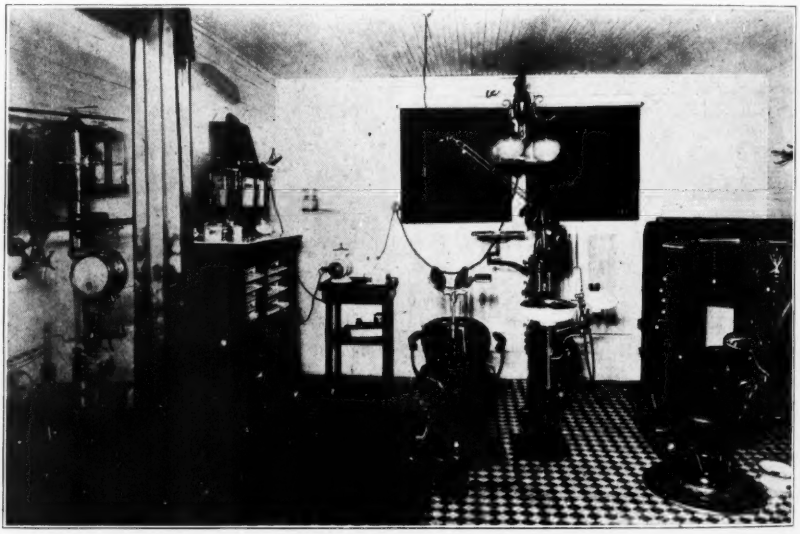


Fig. 2.—First free dental clinic for children at the Jenkinjones Dental Dispensary. When this clinic was started, 99 per cent of the children showed dental caries; 40 per cent showed enlarged tonsils. There was but one perfect set of teeth.

met last month to impose the tax for another year, not one protest was heard from a taxpayer.

Suppose all the counties in all the states should adopt this plan of health work for the children? It would cost a great deal, we admit. But suppose the federal government should offer to do this work on a fifty-fifty basis? It might be possible to make the movement nation-wide, and have all dental work done for all children throughout the country. machinery of this scientific and machine age, and it lessens the number of inmates in our state institutions.

McDowell County Dental Clinic begins teaching the gospel of oral hygiene by lectures. In this way, the expectant mother is taught the importance of her own diet in relation to the child's teeth, and is informed as to the proper diet for her children. In this way, the parents are taught the care of the mouth of young children and the importance and the

Fig. 3.—Gary High and Grade School, Adkin district, McDowell County, West Virginia, with an enrollment of 1,100 pupils with 100 per cent vital permanent teeth.

I do not believe a better investment of money could be made.

I shall explain some of the results of our clinic work which will prove that it is a good business proposition, to say nothing of the humanitarian side of it. It is a good business proposition because it speeds the school children through the grades; it gives safe, sound and capable hands and steady nerves to handle the proper use of the toothbrush; and they are urged to bring the preschool children to the clinics for examination. Also, by education of the parents, a great many improper habits, such as sucking the thumb and fingers, mouth breathing and biting the nails, are broken before the teeth have been injured. In fact, since the establishment of the clinic, we have waged such a campaign against these

habits that, I believe, mouth breathing, the use of pacifiers, thumb sucking and finger nail biting have been eliminated in McDowell County.

The Journal of the American Medical Association, May 12, 1928, contained a report by A. G. Gold, M. D., a professor of hygiene and medical advisor of Cornell University, which was of great interest in consideration of the condition of the mouths of the children of the schools in McDowell County. Dr. Gold made a dental roentgen-ray examination of the 325 Cornell University students, 108 women, 217 men. Of the 325 students, all except sixty-one had at least one pulpless tooth. Dr. Gold says, "Pulpless teeth are preventable, yet 80 per cent of these boys and girls of college age have at least one pulpless tooth." No wonder the question is asked in this article, "Can't we keep the pulps of teeth alive through the mating season?" Yes, the loss of the pulp is preventable, but we must begin to teach oral hygiene early and must preach it persistently.

Referring further to this examination by Dr. Gold, I wish to state that while the dental condition of these students of Cornell University is declared to indicate an 80 per cent failure in preventive dentistry, we do not have similar results in our schools in applying his test. He stated that of 325 students, 264 had devitalized, or pulpless, teeth. We have enrolled in our junior high school, 2,694 students; in our senior high school, 1,024. One hundred pulpless teeth could not be

Fig. 4.—A dental clinic in a graded school in Welch, McDowell County, West Virginia.

found in the whole group of 3,718, the total attendance of the junior and senior high schools. If all the school children in the country had the same dental services that those in McDowell County, West Virginia, have received for the past ten years, our colleges and universities would not receive more than one pupil out of 500 having a pulpless tooth.

There is no doubt that the McDowell County Dental Clinic has accomplished or helped to promote preventive dentistry in our ten years of service to the school children. The progress that has been made in the instruction and care of the teeth is almost unbelievable. For example, at the Thorpe School in Adkin district, McDowell County, the first year the clinic operated, 95 per cent of the pupils required dental service and one-third of the pupils accepted service. The second year, there were but forty pupils who refused treatment. From the third year up to and including the present time, we have given dental service to every child in the school. In the present school year of 1929-1930, this school had an enrollment of 300 pupils, and but eight fillings were needed in permanent teeth. Only three permanent teeth were extracted and these from two children. Does this show that our ten years of work has been in vain? I challenge you to show me a school of this size in the country that can equal this record. We have not completed the inspection of the work of all our schools so far this year, but those that have been inspected show a record which compares very favorably with that of the Thorpe School.

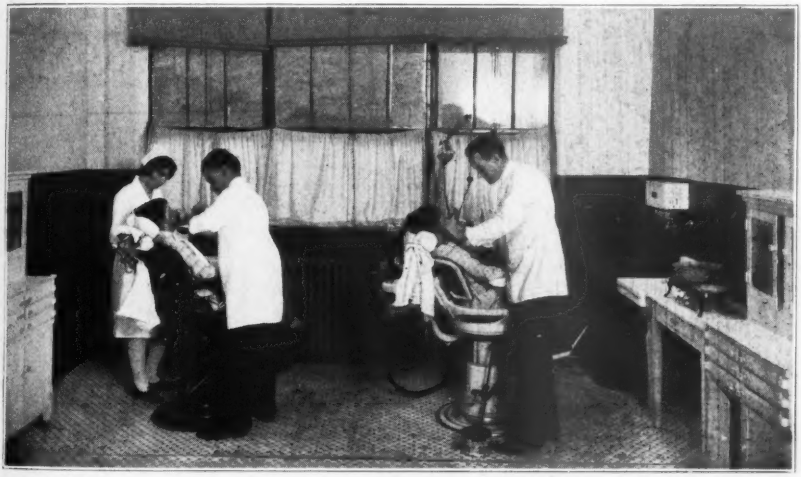


Fig. 5.—Dentists and dental hygienist at work in the dental clinic in the Gary School.

We have also found a remarkable record in the whole of Northfork district, where we have completed the dental work for the graded schools this year. There is an enrollment of 1,916, and the service of only one dentist, working sixty days, was required to complete all dental work necessary for these pupils. We have

not gone into the high schools yet, but we feel sure the record there will be virtually the same.

The total number of extractions of permanent teeth in the whole of McDowell County would be very few were it not for the fact that southern West Virginia is purely a coal mining district and the people move from county to county according to the fluctuations in the coal industry. Unfortunately, McDowell is the only county having the school dental clinic, and, as a result of a constantly changing population, new pupils come to the clinic every year in all of the grades, and many of those to whom we have been giving dental service move out to another county. These new pupils have not had dental service, and it is necessary for us to extract a great number of teeth for them every year. We have six magisterial or school districts, four of which have been developed for many years, and the people do not move in and out so much. In these districts, where we have had only a few new pupils each year, little extraction is done. On the other hand, in two districts which are just being developed and to and from which the people move frequently, we have so many new patients that each year the total extractions in these districts constitute two-thirds of the number for the whole county.

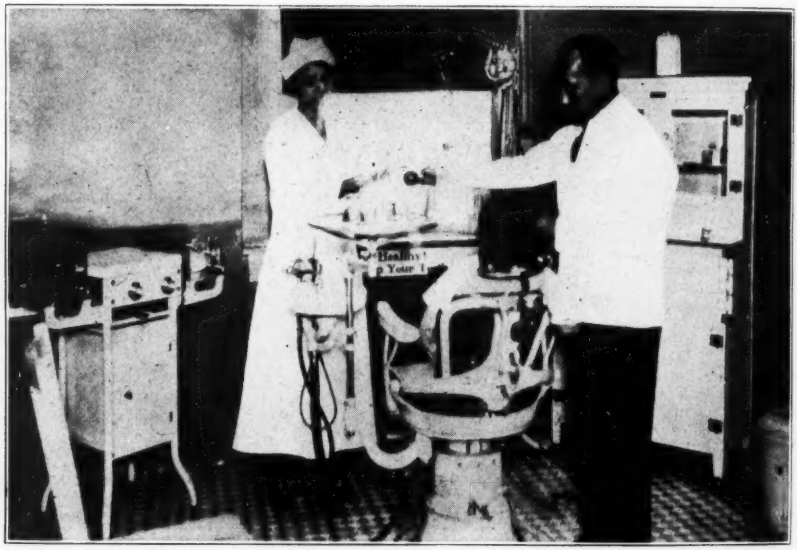


Fig. 6.—Clinic at Northfork Colored High School.

I have explained how the McDowell County Dental Clinic was started, developed and finally reached the standing that it has attained today. The idea originated in the mind of a lay person and was carried out by a member of the dental profession. The benefits to the population more than justify my sincere belief that 5 cents on the $100 valuation is a very small sum to pay for the care

and upkeep of the teeth of our children at the age when such treatment means so much. There is not a member of the dental profession who can deny that this is so. Then, why have not many more of these clinics been established? Is it because the dental profession fears that it will take business away from them? Surely, this is not so. As an example, when the McDowell County Dental Clinic was started, there were seven dentists and a population of 68,000, or about one dentist to every 10,000 people in the county. Now, there are twenty-six private dentists and fifteen dentists working for the dental clinic, making forty-one in all, with the population of 90,000, or three dentists to every 10,000 people. Disregarding the dentists who are employed by the clinic and taking care of the children's teeth, the number of dentists has increased $271\frac{3}{7}$ per cent, while the population increase was only $32\frac{6}{17}$ per cent. Does it then seem that an injury has been done to the profession? Do these figures indicate that the dental profession is justified in opposing such a clinic? On the contrary: the clinic has greatly assisted the dental profession in educating the people to the value of dentistry.

Some interesting information has been gathered through the years of experience in McDowell County. I wish to call attention to a class of forty-seven children who received dental care from the original Jenkinjones Dental Dispensary. This clinic cared for the children of the employes of the Pocahontas Fuel Company up to the age of 14 years. A class of forty-seven of the first grade was designated as a test class to ascertain the results of thorough dental work in schools. Thirty-seven of these pupils re-

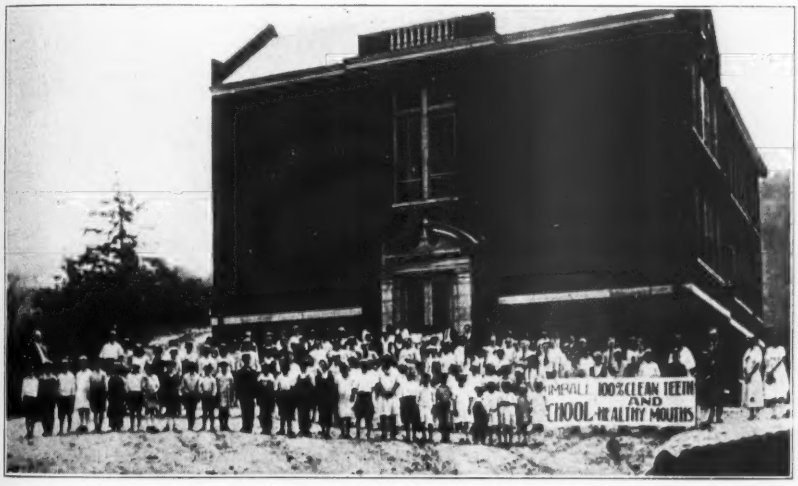


Fig. 7.—Kimball graded school for white children. This school not only shows 100 per cent clean and healthy mouths, but 100 per cent vital teeth, only one permanent tooth having been lost, and this a tooth extracted for a boy who had moved into the county and had just come under the supervision of the clinic.

mained through school; the rest moved and we lost the record of them. Of the thirty-seven, none lost any time from school on account of sickness, the group escaping most of the contagious diseases common in childhood. With but one exception, these children had badly decayed teeth when they were registered with this clinic the first time, in March, 1917; and with one exception, all had diseased tonsils. E. F. Peters, surgeon for the Pocahontas Fuel Company at Maybeury, had charge of the medical inspection and had the tonsils removed in four of the worst cases. After the dental work had all been done, the rest of the tonsil cases cleared up, and tonsillectomy was not necessary. A statement was made by I. T. Peters, who was physician for this Maybeury Class in 1922, as follows: "As a result of dental service in the public schools of Maybeury, I can safely say that we have had a reduction of all diseases among children of school age of at least 60 per cent."

An additional record was kept of the progress made by these pupils. Twenty pupils entering the first grade in 1917 finished the sixth grade in 1922, showing a gain of one year in five. Seventeen pupils entering the first grade in 1917 finished the first year of the junior high school in 1922, showing a gain of two years in five. These statements can all be verified from our records, which are kept on file until the child reaches the age of 16 years, at which time the clinic ceases the dental supervision.

Fig. 8.—Student giving toothbrush drill to children from a lower grade.

In the beginning, it was noticed at the clinic that the children residing in the rural districts had much better teeth than those in the cities, with the exception of the children of the crossroads merchant, whose teeth were found to be even worse than those of the children in the city. This fact led the director to make

an investigation in his work among the children of the Jenkinjones Dental Dispensary, which is a survey covering a part of Tazewell County, Virginia, Mercer County, West Virginia, and Wyoming County, West Virginia, as well as his work as director of McDowell County Dental Clinic covering that whole county. It was learned from the parents who conducted the country stores that most of their children had access to the candy jars and cake boxes.

county superintendent and all district superintendents realize the value of the work of the clinic to the extent that an order was issued making it compulsory for all children to accept the services of the dental clinic and comply with instructions taught by the clinic in oral hygiene. Mr. Dodrill, a superintendent, says in his order, "In the light of our opportunity to receive free dental service, bad teeth among our school children is nothing short of disgrace."

Fig. 9.—Some of the portable equipment used in McDowell County clinics for regions difficult of access.

At the end of a ten-year dental service to these children, we find but few teeth to be filled, the loss of no teeth and but little or no use of a toothbrush. The use of hard foods among these people seems to compensate for the lack of the toothbrush.

From the first, school men have been loud in their praise of the work of the McDowell County Dental Clinic. The

In Figure 4, the McDowell County Dental Clinic in a Welch graded school in operation today is shown with the principal of the school and the dental clinic staff. This is the largest space do nated for a dental clinic by any public school in the world. The dental work is done in many instances in clinics with the most modern equipment, in our largest towns, as shown by the picture of

the Welch clinic. In other instances, portable equipment is used and taken from school to school for the work.

Figure 5 shows the dentists and dental hygienist at work in the dental clinic in the Gary school. No exception is made in our dental service. Colored citizens and their families obtain the same expert care and instruction as to the health of the mouth as do the white. We have six colored dentists and a hygienist, whose business it is to instruct and care for the health of these people. These men report to headquarters at least once a week for instructions and supplies. They keep accurate records of each case as it comes along, and we have a secretary whose business it is to keep these reports on file, ready for use at all times. Figure 6 shows the dental clinic at Northfork Colored High School in operation.

The first examination that is made in the schools is for the retarded classes. This work is finished at the earliest opportunity, and the results are evident in the way the retarded pupils get back to their normal grades. The retarded class of 1926 numbered sixty-seven; the retarded class in 1929 numbered sixteen; which indicates to us that education of the mothers has been effective in reducing to number from sixty-seven to sixteen in spite of the fact that the total enrollment of the school had increased.

In 1922, a campaign was conducted for covering the schools of the county and making the dental work 100 per cent perfect. A great deal of enthusiasm was manifested in the movement by the parent-teacher organizations and by the teachers and pupils, and most of the schools attained this goal. The result of some of this work is shown in Figure 20. Instruction, care and results obtained have taught the people the value of clean, healthy mouths.

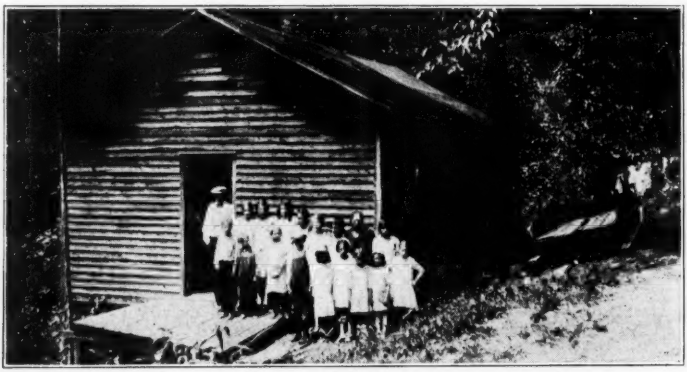


Fig. 10.—Primitive Baptist Church used as a dental clinic, patronized by pupils from six schools.

HARDSHIPS OF THE DENTISTS

Many of you may not believe our record, and after I recount the conditions the dentists have worked under, your doubt will grow even stronger. Thanks to the Army—they showed us a way to meet one of our largest problems—equip-

ment. During the War, the Army Dental Corps had been using a portable outfit that could be easily dissembled and moved from one place to another without much difficulty. This outfit consisted of a foot engine, bracket-table and chair. The rest of our outfit consisted of an oil stove, two pails, a wash basin, a pan for heating water, soap, towels, paper cups and medical supplies. The dentists furnished their own instruments. Picture for yourself a rural district with houses built of clapboards hurriedly nailed together, and no electric lights, telephone service or running water. There were no churches, meeting places or school buildings. Log houses were used for schools. What roads they had were the ordinary dirt variety, barely wide enough to permit the passing of two wagons, and becoming knee deep in mud in the rainy and winter season.

These obstacles had to be gotten over and some have indeed presented a problem. In some cases, we could not reach the schools. In one such instance, we used a Primitive Baptist Church for three years as a dental clinic, and this clinic was patronized by the pupils of six schools, the children of each school being brought to the clinic by the teachers. (Fig. 10.) Good roads have since been built; the old church has been abandoned by the dental clinic and the dental work is now being done in the school houses of the rural schools in McDowell county, except in two or three cases. To reach one of these schools, we load our equipment in an automobile at headquarters and drive as close to the school as possible. With the help of a congenial farmer, we shift our equipment to a sled (Fig. 11) drawn by a horse, and finally arrive at the school. Another of these schools is on Long Branch, situated at the subpower station. The only means of reaching this school with the dental equipment was a coal mine car pulled by a motor for 3 miles through a coal mine. Still another school was Bear Wallow. Here, it was necessary to carry our equipment on horseback over a

Fig. 11.—Transporting equipment.

mountain for 5 miles. We made this school by automobile this year for the first time by going around through the State of Virginia for 50 miles, ending with 7 miles of difficult mountain roads, and being pulled out of a very dangerous place by a team of horses. These are just a few examples of the conditions and problems that one had to contend with to gain results.

Much extra work has been and is caused by athletic activities, as we are continually having cases in which teeth have been lost through accidents in baseball, basketball and football. These teeth are replaced by bridges, using three-quarter crowns. Root canals are treated under the strictest aseptic conditions and checked by roentgenograms. A pulp is never devitalized to make a restoration unless the fracture has involved the pulp, in which case a Richmond crown is placed on the root. We make these dental restorations for all the teams in our county schools, regardless of age.

The records in the office of the McDowell County Dental Clinic show a large number of cases in which children evidenced decided weakness and lack of proper physical development, the cause of which we were able to trace to a diseased condition of mouth and teeth. In almost every instance, after the defects of the mouth and teeth were corrected, a complete cure resulted. We have hundreds of cases that have been treated by the clinic and various diseases were cured after the mouths were put in a healthy condition.

Fig. 12.—Physicians, dentists, teachers and members of the parent-teacher association holding a clinic for preschool children at Hemphill Caples school.

Many cases of disease, the cause of which was Vincent's infection, have come under our observation. In some schools, we find a regular epidemic of it. In many cases, these patients have to come to the clinic as many as thirty times for treatment. We have had many cases also in which it was necessary to go to the homes and treat the family in order to free the children of the disease.

While the McDowell County Dental Clinic is open at all times to preschool children, and the mothers are urged to bring their children to the clinic at an early age, we find it necessary to hold special clinics each year for the preschool children for the purpose of stimulating the interest of the parents in the children's teeth at this early age. We have been greatly helped by the cooperation we receive from the parent-teacher associations. They bring this work up before the parents at their meetings and stimulate an interest, and when the clinics are held, they help to get the children in, bringing them in all day on these days, using their own automobiles, and assisting in all possible ways. At these clinics, we accomplish much good in the way of driving out the fear of the dentist that children often feel. We impress on them, at this early age, the importance of keeping the teeth clean. We come into closer contact with the parents at these clinics, as many of them accompany their children. We are thus able to teach the parents the importance of looking after the temporary as well as the permanent teeth, and also to teach them that the "6-year" molars are permanent teeth. It is difficult to convince parents of this fact at times.

The first year we held these clinics we found that 50 per cent of all the preschool children seen needed dental service.

We distribute various pieces of literature on diet, care of the teeth, prenatal care, etc. All during the year, publicity is given the work by stereopticon lectures in class rooms, parent-teacher clubs, women's clubs and Kiwanis and Rotary clubs. We hold special meetings at the theaters and in the auditoriums and run the latest films on mouth hygiene, such as "Tommy Tucker's Tooth," "Clara Cleans Her Teeth," "Bobby's Bad Molar," and others which we have at the clinic. Posters are made at the schools. We furnish the teacher with posters, songs and other material which she uses in her work in hygiene. Every child in our county today has been taught to use a toothbrush.

It is estimated that if the normal flow of pupils kept up in the schools, instead of so many retarded classes being necessary, 20 per cent or more of the teachers would not be needed. The following figures were compiled by a bookkeeper having access to the records of the school department as well as the records of the dental clinics, which gives some light as to the economic value of the clinic. The cost of one room in school in $1,011. One teacher cares for an average of twenty-five pupils in a year. If twenty pupils gain one year and seventeen gain two years in five, the county saves two teachers a year, or $2,022.00, minus the cost of dental work. Dental work for the Maybeury class cost $721.50; therefore, $1,300.50 was saved. Allowing 50 per cent, for usual intelligence, still $650.25 was saved owing to the fact that the children were kept well and strong by dental service. In other words, the taxpayer has lent to the dental clinic $721.50, and the dental clinic has paid back the principal and a dividend of $650.25 at the end of five years.

SUMMARY AND CONCLUSIONS

1. The number of private dentists have increased in the county 271 per cent, while the population increase is only 32 per cent, in ten years of free dental service rendered the children by the McDowell County Dental Clinic. This fact proves conclusively that free dental service to children so educates the people to the need of dental service that it increases the practice of private dentists.

2. We have driven the fear of a dentist from the minds of the children and have corrected defects and instructed the children in the necessity of a good healthy mouth.

3. We have removed and corrected the source of many diseases such as heart trouble, arthritis, tuberculosis and dental caries.

4. We have proved, by the correction of dental defects, that retarded classes in schools may be materially reduced.

5. As the years progress, the expenses of the clinic have decreased to such an extent that the taxy levy for this work has been cut to one-half of the original tax for this purpose, even though we have a very transient population.

6. After ten years' operation of the McDowell County Dental Clinic, the people have voiced their opinion in its favor by making not one protest against the tax levy for this purpose.

7. This clinic is the only one in the world to be established by an enabling act of the legislature authorizing a vote of the people for a tax levy to finance a dental clinic. The election held for this purpose resulted in favor, by a large majority, of a tax levy for establishing and maintaining the clinic.

8. The results in reducing disease, speeding up the progress of the children through the grades and restoring the health of hundreds have justified the amount of money spent by the citizens, who are the taxpayers and who, therefore, finance the clinic.

9. Surely, this plan could be extended to give the same service to all children, both rich and poor throughout the United States. When the taxpayer pays $2 into the school fund, only 5 cents goes to the dental clinic, if conducted as is the McDowell County Dental Clinic. If the federal government would contribute one-half the amount, the taxpayers in the county and municipality would have to add only 2½ cents to each $2 paid into the school fund to provide for the expenses of the dental clinic. This small amount of money would be repaid through elimination of the need for extra school rooms and extra pay to teachers to continue in school "the great number of retarded children" who must repeat from one to three years because of lack of dental services.

It is a revelation when a layman can see the future of dentistry to the extent of spending thousands of dollars of his own money, as did Col. James Ellwood Jones, to promote this work. He not only made the clinic possible in the beginning, but also has given it his personal attention and assistance through the ten years of its existence. He has thus not only enabled the children in this mining district to learn of the value of dentistry, but also has made it possible for them to have its principles applied through his unselfishness and generosity. By a ten year trial, Colonel Jones, as founder, has proved the efficiency and the right to exist of the dental clinics in McDowell County, West Virginia.

CURRENT LITERATURE

EXTRACTS AND ABSTRACTS

Ultraviolet Rays in Periodontal Disease: For the purposes of this study, A. T. Rasmussen (*Arch. Phys. Ther. X-Ray Rad.*, May, 1930) divides diseases of the periodontal structures into (1) inflammatory conditions resulting from trauma, chronic irritation or drugs; (2) infections the result of specific pathogenic micro-organisms invading the tissues, and (3) lesions resulting from, or a part of, some general systemic disturbance. In the first group, trauma or irritation may result from the presence of broken down teeth, filth, poorly constructed or improperly fitted crowns or bridges, of poorly contoured or overhanging tooth fillings, and the condition ensuing may range from slight inflammation to tumefaction with vascular congestion, followed by infection and necrosis of the parts. Similar conditions may arise from the use of some drug or mineral. Irradiation will assist in reducing congestion, swelling, pain and hemorrhage, and in improving circulation. The cause of the disturbance must, of course, be removed to prevent return of the symptoms. Further irradiation will hasten the return to normal. Irradiation in infections, which are usually attended with a lowering of the alkali content of the body fluids, tends to bring the latter condition back to normal, and promotes celluluar activity, increasing circulation and so carrying off the bacterial toxins. Organisms coming in optical contact with the rays are destroyed. In Vincent's infection, ultraviolet radiations decrease the clotting time by increasing the calcium in the blood. Thus, hemorrhage is avoided and curettement becomes possible without danger. Irradiation is, of course, only an adjuvant in this condition, as diet, medication and elimination of pockets and all sources of irritation are necessary. The same is true of other periodontal conditions. In group three are all periodontal diseases which have as their primary cause some underlying systemic disease or disturbance of the metabolic processes. In periodontoclasia or osteoclasia, irradiation promotes recalcification of the bones if destruction has not been too great. In osteomalacia, a deficiency disease, because of a lowered calcium or phosphorus index, a demand is made on the bones for these minerals. The minerals are absorbed more readily from the highly vascular alveolar process than from the denser bones, and what is needed is something that will activate the metabolic processes so that instead of continually drawing out the mineral salts, these salts will be assimilated from the food and deposited in the skeleton. This may be accomplished by irradiation or by the employment of irradiated substances such as cod liver oil or ergosterol.

Vincent's Infection of Vagina: C. H. Arnold (*J. A. M. A.*, May 10, 1930) reports a case of Vincent's infection in a woman, aged 35, who first came in for treatment because of weakness, fever, nausea and sore mouth. The breath was very bad. She had tried taking acetylsalicylic acid, using a mouth wash and resting in bed, but did not improve. She was rather thin, appeared dyspneic and had rather a jaundiced color. There was profuse salivation and the gums showed grayish white patches. General examination was negative except for a tear and irritation of the mouth of the uterus and a profuse discharge. Vincent's organisms were found in a smear taken from the mouth. The use of sodium perborate as a mouth wash and an injection of neo-arsphenamin improved the mouth condition but the vaginal orifice was greatly irritated although hot sodium bicarbonate douches had been used. Mouth smears showed very few organisms, but vaginal smears were positive, and a characteristic grayish white patch was found within the vagina. The patient seemed so ill that she was ordered to bed. Urinalysis revealed some albumin and, blood examination showed an agranulocytosis with an absolute leukopenia and relative increase in small

mononuclears, a condition which the author states he has observed in twenty cases of Vincent's infection of the mouth. Treatment was continued with neo-arsphenamin and sodium perborate alternated with hydrogen dioxid as a mouth wash. The vaginal patch was treated with neo-arsphenamin and glycerin in the form of paste, and hot douches of 1:500 potassium permanganate were prescribed. In ten days, the organisms could not be found. The patient was placed on a tonic and diet, and six weeks from the time that she went to bed, had gained 10 pounds. She continued to complete recovery.

Scurvy Following Restricted Diet in Colitis: A case of scurvy developing in a patient being treated for colitis is reported by S. L. Immerman (*J. A. M. A.*, May 31, 1930). A woman, aged 42, had been on a restricted diet for eleven months, during the last three months of which the diet was greatly restricted, consisting almost entirely of boiled milk. During the earlier months, rice, custard, junket, chicken broth with barley, soft boiled or poached eggs, milk toast, white meat of chicken and lamb chops had been permitted. Improvement in the condition was shortlived when an attempt was made to add carrots, spinach and peas to the dietary. Under this régime, the weight had increased from 126 to 160 (the weight before colitis developed had been 172). After three months on the boiled milk diet, the patient began to show marked symptoms of scurvy. Purple spots were noted on legs, arms, chest and abdomen and slight trauma caused bleeding under the skin. A little later, the gums became swollen, purple and sore. Use of a toothbrush caused bleeding and there was some nosebleed. A month after these symptoms were first noted, pain was felt in the ankles and then in the knees. The skin was harsh and dry. The patient was given the juice of three oranges daily, and after three days, the purple spots began to fade, the gums were less spongy and the swelling had left the ankles. In another week, all symptoms were much more favorable and the patient could walk comfortably. The author rules out other forms of purpura in this case because of the prompt response to treatment and in consideration of the manifest inadequacy of the diet for eleven months. He warns against the dangers of continuing too long a diet in which there is vitamin deficiency.

Croup: In an analysis of 344 cases, D. M. Tolle (*Am. J. Dis. Child.*, May, 1930) discusses the suction treatment of laryngeal diphtheria and the treatment of catarrhal laryngitis and tabulates other observed causes of croup, in this series the presence of a foreign body, retropharyngeal abscess and polyp. In one case, two pieces of chestnut shell were removed after three days from the left bronchus of a girl, aged 2½ years. Death ensued from purulent tracheobronchitis and bilateral bronchopneumonia.

Early Rheumatic Infections of Childhood: One hundred and eighteen cases in children from 2 to 13 years of age are reported. (C. C. McLean, in *Arch. Pediat.*, November, 1929). These included fifty-one boys and sixty-seven girls. The chief age incidence was from 3 to 9 years. Eighty-nine of the patients gave a history of repeated attacks of tonsillitis, with nasopharyngeal infection. Sixty-seven per cent had pains in the extremities. Forty-two, or 35 per cent, had mild chorea; 53.2 per cent of the chorea patients and 81.5 per cent of the remainder had a soft systolic cardiac murmur. Roentgen studies showed little or no cardiac enlargement. Of the entire group, 87.3 per cent were underweight. In fifty-seven cases, the focus of infection was in the tonsils; of these, 94.7 per cent showed soft blowing systolic murmurs. In sixteen cases in which the focus was located in the teeth, only 25 per cent showed cardiac murmurs. The blood counts ranged from 6,000 to 31,000; usually from 7,000 to 15,000. In the early rheumatic cases, the patients are kept in bed from four to six weeks with the exception of four hours a day during which time they are usually allowed to do as they please. They are given a six meal diet, with emphasis on spinach, prunes, whole wheat and cereals. They are also given cod liver oil and iron.—Abstr. *Am. J. Dis. Child.*, May, 1930.

Foreign Literature

Quantitative Side of the Root Canal Problem (Hans Pichler, Ztschr. f. Stomatol., Vol. 28, No. 4, 1930): Discussion of the question of oral sepsis has made the dental profession realize that every root canal treatment involves much responsibility. Although the diversity of opinions concerning this problem is still great, two points have to be considered as proved: that periapical foci of inflammations can cause severe disease of the entire organism, and that such foci can be caused by

inadequate root canal work. Up to this time, we have no absolutely sure method of preventing the development of periapical foci of infection following pulp treatment. But we must not forget that no therapeutic procedure in medicine can be guaranteed to be 100 per cent successful. Failures are always possible. Moreover, the extraction of a tooth can be followed by complications and can be dangerous to the patient's health; a fact that has never been stressed by those who advocate the extraction of all pulpless teeth. The conditions that determine whether or not an infection develops in a treated tooth are: the virulence of the bacteria, the resistance of the organism and the number of bacteria present. We are as yet unable to influence the first two conditions, but we can control the number of bacteria by reducing as far as possible the area in which they grow and develop by means of mechanical filling of the root canal. From this standpoint, Pichler considers the problem a quantitative one: the fewer possibilities there are for bacterial growth, the easier it will be for Nature to overcome the rest of the bacteria and secure sufficient healing around the apex. Pichler recommends the use of guttapercha cones as filling material, together with cement. A thin mixture of cement is introduced into the root canal and the cone is then pushed in, sealing the canal and pressing the cementum as far as possible into the ramifications. By this method, he tries to eliminate the free spaces in the root canal that would otherwise allow bacteria to develop.

RUDOLF KRONFELD, Chicago.

Plexis Anesthesia and Changes in the Pulp and Periodontium (Silvio Palazzi, Ztschr. f. Stomatol., Vol. 28, No. 4, 1930): The author made experimental investigations on the teeth of man as well as of animals, by injecting into the nerve plexus a solution of procain and epinephrin, in endeavoring to find out whether there was any effect to be observed in the tissues of the pulps of such teeth. Injections were made in men in the usual method under the mucous membrane of the vestibulum. A short time later, a tooth was extracted and sectioned. A stasis in the capillary vessels and very small hemorrhages could be found in the pulp tissue. The periodontal membrane showed anemia due to the action of the epinephrin. The changes in both the pulp and the periodontium were merely of temporary nature. Twenty days after the injection, no tissue changes whatever could be found.

RUDOLF KRONFELD, Chicago.

Dentin Anesthesia, with Special Consideration of the Gazotherme Method (Alfred Kieferle, Deutsch. Monatschrift f. Zahnheilk., Vol. 48, No. 10, 1930): The author discusses the question as to whether the sensitiveness of the dentin is due to the presence of nerves in the dentin or to protoplasmic processes in the dentinal tubuli. He believes that the latter conception is correct and that there are no nerves in the dentin. The sensitiveness of the living protoplasm in the dentinal tubuli has to be overcome in order to make the operations of the dentist, such as cavity preparation, painless. Different methods and drugs are used for this purpose. All drugs that are applied locally on the dentin either by pressure (cocain) or by sealing in the cavity (phenol) are likely to damage the pulp and sometimes to cause necrosis of the pulp tissue. The author recommends chilling to produce temporary anesthesia of pulp and dentin. The method has been developed by Fabret, who built a special apparatus for this purpose, calling it a gazotherme. A fine stream of gas is directed toward the sensitive dentin and the temperature is lowered slowly to –3 and –10 C. (26 and 14 F.), when the dentin is completely anesthetized. The gas used for this purpose is pure oxygen. Compressed carbon dioxid is used to cool the oxygen to the desired temperature. A rubber dam is necessary in all cases in which the gazotherme is used. First, pure oxygen is blown against the dentin, then gradually the temperature is lowered by means of carbon dioxid until the tooth is covered with frost. It is then possible to excavate and prepare a cavity without pain. In case of a pulpitis, the application of the gas has to be done especially carefully and slowly, but it is possible to excavate the carious dentin and to put arsenic trioxid on the pulp without pain. The author emphasizes the advantages of the method for the preparation of the very sensitive cavities of the neck of teeth. He claims that there is no pain following the application of cold and no permanent damage ensues to the pulp tissue.

RUDOLF KRONFELD, Chicago.

Biologic Investigations Concerning the Noxiousness of Some Metals and Varnishes Used in Making Tubes for Tooth Paste

(Hermann Junker, Deutsch. Monatschrift f. Zahnheilk., Vol. 48, No. 9, 1930): In order to determine to what extent the lining of a tooth paste tube can influence the content by solution of the metals, the author enclosed water in tubes for a long time (weeks) and then used this water as a culture medium for micro-organisms. The tubes consisted of pure tin, pure lead or tinned lead, and tubes covered with different varnishes. The water that had been kept in these tubes was tested as to its influence on the germination of bacteria, yeast, monocellular animals and different seeds. It was found that tin had no influence, whereas, lead had a toxic reaction and in the experiments hindered the development of life. Tinned lead acted in different ways: If the cover of tin was good, there was no toxic lead action; if it was poor, the lead acted as poison. The varnished materials were also variable in their action. These biologic findings are in accordance with the ones obtained by medical and chemical tests.

RUDOLF KRONFELD, Chicago.

Errors in Dental Surgery (Gustav Hesse, Fortschr, d. Zahnheilk. [Leipzig: Georg Thieme], No. 3, 1930, p. 224): Removal of hypodermic needles that are broken off during mandibular injections is contraindicated according to Loos, Praeger, Kantorowicz and Williger. Loos advocates removal only if serious complications develop. He reports six cases in which the needles remained within the tissues without any reaction; in two cases, inflammation and swelling developed. Whenever these symptoms occur, removal is indicated. The accompanying soreness facilitates locating the needles. Hesse, on the contrary, insists that attempts at removal should be made immediately in every case. He suggests that another hypodermic needle with its hub be at once inserted as closely as possible into the same place and in the same direction as the broken off needle. With this in position, roentgenograms should be made to assist in locating the broken needle. The operation is then governed by the relative position of the broken needle to the control needle. The incision should be made at right angles to the needles. The use of nitrogen monoxid in dental anesthesia has again been revived in Germany. Deaths from this gas are usually the result of insufficient oxygenation according to Sudek. In prolonged anesthesia, he uses from 10 to 20 per cent oxygen. He has administered nitrogen monoxid in 4,500 cases without a fatality. . . . Whether pyorrhea should be treated medicinally or surgically is still a much disputed question. Extremists advocate one method to the exclusion of the others. The best results are obtained with a combination of both methods. The beginning cases are usually successfully controlled with medicinal treatment. The more stubborn cases that do not yield to this treatment should be surgically controlled. Diligent and proper prophylaxis by the patient is subsequently necessary in all cases if lasting results are to be obtained.

EMIL MUELLER, Chicago.

Paradental Pyorrhea and Alveolar Atrophy (Bernhard Gottlieb, Fortschr. d. Zahnheilk. [Leipzig: Georg Thieme], No. 5, 1930, p. 350): Becks has developed a new conception relative to pocket formation and progressive eruption of teeth. He believes with Gottlieb that there exists an attachment of the overlying epithelium with the enamel. Contrary to Gottlieb's opinion, he contends that shifting of the bottom of the crevice until it reaches the cemento-enamel junction is due to the degeneration of the enamel epithelium. After the detachment of the epithelium reaches this point, the bottom of the crevice assumes a more or less stationary character. While some, purely upon the basis of clinical impressions, may favor this conception, histologic evidence, supporting this conception, is still wofully lacking. Becks, in one histologic illustration which he offers in its support, does everything but prove his point. Gottlieb criticizes this illustration because of the fact that the bottom of the crevice is still above the cemento-enamel junction and not at the cemento-enamel junction as Becks contends. . . . As a result of further investigations by Weinmann, we are further justified in stressing the constitutional factors in diffuse atrophy. Weinmann has been able to verify the very significant findings of Becks; viz., that in diffuse atrophy, the calcium and phosphorus of the saliva was reduced 25 per cent and magnesium 40 per cent; while the potassium and sodium was increased. Becks also found in pregnancy a 50 per cent reduction in calcium; a reduction of bicarbonate and sodium of the saliva, but an increase of magnesium and phosphate. Citron as well as Weinmann observed that the calcium of the blood increased appreciably in diffuse atrophy.

EMIL MUELLER, Chicago.

MISCELLANY

BOOK REVIEWS

Index of the Periodical Dental Literature. Published in the English language including eighty-seven publications in England, Canada and the United States, for five years, 1896-1900. A classified subject index on the plan of the Dewey Decimal Classification; an alphabetical author index; a list of dental books reviewed during the same period. Compiled by Arthur D. Black, A.M., M.D., D.D.S., Sc.D., Dean, Northwestern University Dental School. Published by the Dental Index Bureau, 381 Linwood Avenue, Buffalo, N. Y., and by Henry Kimpton, 263 High Holborn, London, England, under the auspices of the American Association of Dental Colleges, American Dental Association, Research Commission of the American Dental Association, British Dental Association, Canadian Dental Association, New Zealand Dental Association, and Society of Dental Science of New South Wales; 1930. Administrative Board of the Dental Index Bureau: H. E. Friesell, Chairman, Pittsburgh, Pa., Arthur D. Black, Editor, Chicago, Ill., Abram Hoffman, Secretary-Treasurer, Buffalo, N. Y., William Bebb, Librarian, Chicago, Ill.

A detailed review of a work as well known as this is unnecessary, especially when it has already eminently proved its value. The present volume is the ninth of the series, and when the entire work is completed, it will prove one of the great literary feats of the profession. Too much credit cannot be given the editor, Dr. Black, for inaugurating this work and carrying it to its present stage of completion, and when the work is finally finished, he will have the satisfaction of knowing that he has achieved an outstanding service for dentistry. No dental library can be considered complete without this index.

Infant Nutrition. A textbook of infant feeding for students and practitioners of medicine. By Williams McKim Marriott, B.S., M.D., Professor of Pediatrics, Washington University School of Medicine; Physician in Chief, St. Louis Children's Hospital, St. Louis, Mo. 375 pages; illustrated; price, $5.50. Published by the C. V. Mosby Company, St. Louis.

The opening sentence of the preface to this book is significant. The author says: "There is perhaps no field in medical practice in which more difference of opinion has existed than in that of infant feeding." With this fact in mind, the author has attempted to systematize the subject and simplify it as much as possible, with the result that he presents a working basis for the nutrition of infants that must command respect. This does not by any means imply that all infants can be fed the same diet with the same result. There is one feature of the study of diet and nutrition which is seldom emphasized by writers, and that is the varying idiosyncrasies which manifest themselves in the reaction of different individuals to a given diet. That this question of idiosyncrasy must be reckoned with, there can be no question, and while there are certain fundamentals connected with the study of nutrition, the dietician who with the study of nutrition, the dietitian who diet and fails to recognize the necessity for occasional variation to meet individual needs will not go the farthest in the intelligent regulation of the nutrition of those committed to his care. Dr. Marriott devotes a chapter to the much discussed subject of vitamins, and it is a chapter well worthy of reading and study, though he states that "the exact mode of action of the vitamins is unknown." With this, we must all agree, and yet this does not mean that a study of the vitamins is at all unprofitable. A brief chapter is devoted to "nutrition and development of the teeth," which will prove of especial interest to dentists. In fact, the entire volume is sufficiently enlightening to justify careful study by the progressive dental practitioner. It is a subject on which he should be intelligently informed, and the present volume will prove a substantial aid in this direction.

Dental Formulary. A practical guide for the preparation of chemical and technical compounds and accessories as used in the

office and laboratory by the dental practitioner, with an index to oral diseases and their treatment. By Hermann Prinz, A.M., D.D.S., M.D., Sc.D., D.M.D., Professor of Materia Medica and Therapeutics, the Thomas W. Evans Museum and Dental Institute, School of Dentistry of Pennsylvania, Philadelphia, Pa. Fourth edition, thoroughly revised; 364 pages; price, $3.50 net; published by Lea & Febiger, Philadelphia, Pa.

To those who are familiar with the work of Dr. Prinz in this department of dental science, a mere announcement of the appearance of a fourth edition of his book will be all that is necessary. But his riper experience and his intimate contact with the subject since the preparation of the third edition has made it possible for him to revise his work and make many additions. This book is a most valuable volume to have conveniently at hand and no practitioner should be without it. For review work particularly it is worthy of every commendation. A very significant thing in connection with this work is the fact that in case a mouth wash or a tooth paste or powder is needed, the formula may be found readily at hand, and the ingredients are therefore known, and may be used with confidence. It is a carefully prepared volume and is worth many times its price.

Those Teeth of Yours. A popular guide to better teeth. By J. Menzies Campbell, L.D.S., D.D.S., F.R.S.E., F.I.C.D., Fellow of the Royal Society of Medicine, Member of the Hygiene Commission, International Dental Federation, Member of L'Association Générale des Dentistes de France, Member of La Société de L'Ecole et du Dispensaire dentaire de Paris, Associate Member, Canadian Dental Association, Associate Member, American Dental Society of Europe. 17 illustrations; 141 pages; price, 3 shillings and 6 pence, net. Published by William Heinemann (Medical Books) Ltd., London, England.

This is a most readable book. The idea of the author has been to present the subject in the simplest possible language so that a lay reader may readily follow it, and not be confused by technical terms. An idea of the scope of the book may be had from a glance at some of the topics. The author treats of such subjects as the history of dentistry, the teeth and their surrounding parts, dental caries, pyorrhea alveolaris, the extraction of teeth and insertion of artificial dentures, children's teeth, the expectant and nursing mother, the teeth in relation to health, and a consideration of dentistry as a career. The various subjects are treated in a most concise manner, and the book is very entertaining throughout. It is probably true that no book was ever written about which there could not be advanced certain questions as to statements of fact. In one place in this volume, the theory is quoted that in the case of the pregnant woman, the lime salts of the teeth of the mother are depleted to build up the teeth of the child. That the teeth of the child-bearing woman sometimes suffer is well known, but it has never yet been proved that it is due to extracting the inorganic materials from the mother's teeth to build the child's, and from the character and nature of tooth structure, it is questionable that it ever will be. This idea has sifted on down through the years, but its tenacity should not be taken as any measure of its validity. Dr. Campbell's book as a whole is well worth reading, and it may be opened at almost any chapter with the assurance that something of interest will be found.

New Investigations About the Saliva, with Special Reference to Pregnancy and Periodontal Disease. By Hermann Becks (M.D., Med. Dent.); Hooper Foundation for Medical Research, University of California, San Francisco. Edited by Hermann Meusser, Berlin, 1929.

Interest in the saliva is still great, as there are many yet unsolved problems involving it. The saliva, which is always present in the oral cavity, must naturally be of great importance to all normal and pathologic changes that occur in that field; therefore, physicians and chemists have done an enormous amount of work on the saliva, its composition and significance under various conditions. In spite of the publication of numerous opinions, Becks' monograph must be considered as a standard work because of the unusually exact methods which this author used for his investigations, as well as the very clear connection with the vital practical questions of dentistry. Becks first gives a short review of the results obtained by former authors and then proceeds to a description of his own investigations. He obtained saliva for his analyses with unusual care, eliminating all possible factors that might alter its composition. To determine the reaction of the saliva, the p_H was first

Fig. 1.—Omaha District Dental Society Study Club room.

Fig. 2.—Omaha District Dental Society Study Club room.

determined. Becks found a regular variation of the p_H during the day, a slow increase between morning and evening. The amount of albumin contained in the saliva decides whether it has a basic or an acid reaction. In cases of increased content of albumin and mucin, for instance during pregnancy, the p_H is also increased. In children, the p_H increases with age. In children whose teeth are in good condition, the p_H indicates an almost neutral saliva; whereas, the saliva of children with caries shows an increased p_H. Another factor that is included in Becks' investigations is the viscosity of the saliva. Viscosity means the inner friction of the particles of a fluid. It is measured by comparing the time that a certain amount of fluid takes to run through a capillary tube with the time required for water. The viscosity of the saliva changes very much. Sugar increases the viscosity considerably, and a salt solution causes a decrease. Generally, the viscosity depends on the content of albumin (mucin) in the saliva; the more mucin the saliva contains, the greater the viscosity. In children with frequent caries, the saliva showed a high viscosity; thus, the mucin seems to be, to a great extent at least, responsible for the frequency of caries. The calcium content of the saliva is subject to variations every day as well as throughout life. In youth, the saliva contains a certain amount of calcium, which remains constant until middle age. From then on, the calcium content increases considerably. Also for sodium and potassium, the figures are fairly constant up to about 40 years of age, after which these cations increase in the saliva. This fact may be explained by the fact that, in later life, the body does not need all the salts that are taken in with the food, as there is no longer building of the skeleton, and therefore a higher percentage of these salts is eliminated by way of the saliva. For all anions as well as for the cations, Becks gives very accurate data concerning amount, chemical qualities and distribution in relation to different periods and conditions of life. Chlorin, phosphorus and rhodan are discussed here. During pregnancy, there is a reduction of the calcium content to as low as 50 per cent of the physiologically normal amount and at the same time an increase of magnesium and phosphorus. The calcium content of the blood serum is increased during pregnancy; thus, it becomes evident that Nature economizes with the calcium at this time, and reduces the amount of this important substance that is otherwise lost by way of the saliva. In cases of diffuse atrophy of the alveolar bone, clinically characterized by loosening of the teeth, calcium and phosphorus are decreased in the saliva with about 25 per cent magnesium, even with 40 per cent; whereas, the sodium content is much increased. In cases of merely inflammatory changes of the gums, such as Vincent's infection or filthy mouth pyorrhea, the content of ions did not show a deviation from the norm. These findings are of great practical interest. In connection with the analysis of the saliva and the investigations concerning the calcium content, Becks has made experiments with different tooth pastes. He found that almost all the different tooth pastes and tooth powders favor the formation of calcium salts that lead to calculus. Only plain precipitated chalk has no influence on the saliva. This work of Becks should be studied and considered very carefully by every one who is working and interested in the physiology, chemistry and pathology of the oral cavity.

RUDOLF KRONFELD, Chicago.

THE STUDY CLUB ROOM OF THE OMAHA DISTRICT DENTAL SOCIETY

By Edward H. Bruening, D.D.S.,
Omaha, Nebr.

A very efficient study club room has recently been fitted up by the Omaha District Dental Society in the pent house above the eighteenth story of the new Medical Arts Building.

At this time, there are in operation the following study groups:

Gold casting: A group of twelve studying the behavior of waxes, investments and golds. This is being done under the direction of the Bureau of Standards.

Clinical practice: Anesthesia, local and general; postoperative treatment, etc.

Dissection. This group is working with normal and pathologic tissues.

Ceramics: A study of porcelain in all its uses in dentistry.

Partial dentures (a twenty-weeks course).

Gold foil manipulation and cavity preparation.

Sixty dentists are engaged in study club work in Omaha at this time and are enjoying their experiences very much.

PROFESSOR PICHLER MADE DEAN

By Rudolf Kronfeld, M.D., Chicago, Ill.

Prof. Dr. Hans Pichler has been made dean of the Dental School of the University of Vienna, and has been given the title of "official professor of dentistry."

The old and famous Dental School of Vienna has been without an official dean since the death of Prof. Rudolf Weiser in the fall of 1928. Professor Pichler has been temporarily in charge of the school since that time. Now, dentistry in Vienna secures a new leader who has an excellent reputation both as a surgeon and as a dentist.

Professor Pichler graduated in medicine from the University of Vienna and continued his work there at the Surgical Clinic under Professor Eiselsberg. He then went to Chicago where he studied dentistry at Northwestern University. At this time, he became acquainted with the work of Truman W. Brophy and G. V. Black, which was responsible for much of his later development. Pichler translated Black's textbook, "Operative Dentistry" into German, and thus Black's principles of cavity preparation became known and accepted all over Europe.

Pichler's work in minor as well as major surgery deals with all known types of disease of the oral cavity and the face. He is a specialist in cleft palate and cleft lip operations. His experience in operations on tumors of the jaws, especially carcinomas, has contributed greatly to his reputation. During the war and the years following, he did wonderful work in the field of plastic surgery of the jaws and face. On the other hand, at no time has he considered any dental operation too unimportant for his consideration; thus, he also developed an outstanding technic in root canal work, root resection and operations upon dental cysts.

These are but a few of the many different problems studied and enlarged on by Pichler. The University of Vienna and the dental profession over all the world can be congratulated that this man is now given the best possible opportunity to continue his work for the benefit of humanity.

NEWS

Children to Be Excused from School for Dental Service: According to the *Chicago Dental Society Bulletin,* the superintendent of schools in Chicago, in compliance with the request of the Public Service Committee, has issued a bulletin to school principals instructing them to excuse pupils for dental service when necessary if proper request is made by their dentist. In order that there may be no chance of abuse of this privilege, it is required that the dentist use an appointment form with a report of the presence of the patient at the time designated. A card is to be presented to the teacher before, and returned by the pupil after, each appointment. The parent and the dentist also have to write a note to the principal or the teacher asking that the child be excused.

Former Employes of Painless Parker Secure Revocation of Board Order: According to the *Denver News* of June 5, action of the state board of dental examiners of Colorado in revoking the licenses of five Denver dentists formerly employed by the Painless Parker System was ordered revoked, June 4. The licenses of the dentists, Joseph R. Walsh, B. G. Savelle, A. W. Heitler, Charles W. Patch and John Henry Miller, were revoked by the state board on the ground that they were guilty of unprofessional conduct because they accepted employment from a corporation. In petitions filed, Nov. 19, 1929, asking the district court to review the decisions of the state board, the five dentists named also asked the court to restore them the right to practice dentistry in the state. The Painless Parker System was prohibited from operating in Colorado, April 15, 1929.

Resolution Regarding Advice on Need for Orthodontic Treatment: The following resolution was passed at a recent meeting of the American Society of Orthodontists:

Realizing the increasing interest that is being taken by school officials, health departments, and other organizations everywhere in the improvement of dental health among children, and believing that malocclusion is one of the most serious and important of remediable dental defects, and

WHEREAS, the disregard of this deformity in the inspection of children's mouths results in misleading reports being sent to parents and otherwise published; therefore, be it

Resolved, that the American Society of Orthodontists recommend that all examinations or inspections of the mouths of children for dental defects properly should include in addition to items already provided for a notation of malocclusion where present or impending and advice as to its correction; and be it further

Resolved, that these resolutions be given as wide publicity as possible by publication in the several dental journals and the bulletins of state and other dental societies and organizations engaged in child welfare work.

Gorgas Memorial Essay Contest Awards: On May 12, President Hoover awarded the Charles R. Walgreen Prize of $500 for the winning essay in the second annual Gorgas Memorial Essay Contest to Pauline Lodge, Lakewood, Ohio, High School senior. The subject of this year's contest was "The Gorgas Memorial; Its Relation to Personal Health and the Periodic Health Examination," and more than 5,000 essays were submitted by high school students from all parts of the United States. A state prize is awarded for the best essay in each state, and from these papers the national winners are selected. There is a second prize of $250 and a third of $100. State prize winners are given $20. The objects of the Gorgas Memorial Institute, for the promotion of which the Walgreen Annual Essay Contest is held, are to (1) eliminate unnecessary illness and check diseases in their early stages, thus (*a*) saving the 750,000 lives lost annually in the United States, owing to preventable disease; (*b*) saving the 300,000,000 days lost annually because of illness and nonindustrial accidents of 46,000,000 gainfully employed persons; (*c*) building up the 25,000,000 youths and adults in the United States who are now physically below par; (*d*) laying the foundation for healthier future generations by giving the present day mothers and fathers authoritative medical information; (2) make life healthier, more enjoyable and more productive, and increase its span from 58 years, its present average, to 65 or 70 by educating the public to submit to an annual health audit by the family physician and the family dentist, who should be the custodians of health; (3) eradicate tropical diseases, thus opening to habitation territories of enormous wealth; (4) eradicate mosquitoes, which are both a pest and a health menace (malaria alone costs the country $100,000,000), and (5) free all the world from preventable disease, the purpose to which the life of General Gorgas was dedicated.

West Virginia Society Elects Officers: The following are the newly elected officers of the West Virginia Dental Society: president, H. H. Smallridge, Charleston; first vice president, C. Ray Strum, Fairmont; second vice president, C. L. Callaway, Beckley; secretary (reelected) J. E. Herbert, Martinsburg; treasurer, John S. Stone, Clarksburg. The next annual meeting will be held in Huntington.

Dr. Franken to Czechoslovakia: S. W. A. Franken, chief of the dental department of the Lenox Hill Hospital, New York City, sailed, May 23, to give a series of lectures on modern American dentistry and some phases of original surgical technic, at the University of Prague, at the invitation of the Czechoslovakian government

Cleveland Dental Society Elects Officers: The following officers were recently elected by the Cleveland Dental Society: president-elect, C. J. Stark; secretary, T. J. McDermott (reelected); treasurer, R. J. Armstrong (reelected). W. A. Loope is president.

Maryland State Association Elects Officers: At the recent annual meeting of the Maryland State Dental Association, the following officers were elected: president, Karl P. Heintz, Cumberland; president elect, George M. Anderson, Baltimore; vice president, R. O. Higgins, Salisbury; secretary, Norval H. McDonald, Baltimore; treasurer, Walter E. Green, Baltimore. The sixth semiannual meeting of the association will be held September 8-9, at Ocean City, Md.

Journal of Periodontology: The first issue of the *Journal of Periodontology* published by the American Academy of Periodontology contains a condensed account of the last annual meeting and the meetings of the 1929-1930 Council and other subject matter of especial interest to the Academy membership. The second issue is to contain abstracts of articles on periodontology which have appeared since 1926 as well as reviews of recent books. It is the present plan to publish two issues in 1930. The first issue is dedicated to the late Gillette Hayden.

Dr. Black Returns from Japan: Arthur D. Black, dean of Northwestern University Dental School, recently returned from a trip to Japan, where he spoke before the Japanese Medical Congress. Dr. Black made twenty addresses, including public lectures, radio talks and lectures to dentists and students. He was the first foreigner to address dental classes in Japan.

Mellon Institute Plans New Building: Mellon Institute of Industrial Research, Pittsburgh, Pa., is to increase its facilities for serving American industries by a build-

ing project that will enable the material expansion of all its research activities. Detailed plans are now being prepared and construction will begin as soon as the drawings are completed, early this fall. The building will provide ample space for housing many more industrial fellowships than the sixty-three that now tax the Institute's facilities to the utmost. The other departments of the institution will be increased in proportion. In addition to providing a greatly increased number of laboratories, the new building will give more commodious quarters for the general departments. The present library contains 11,000 volumes; the new library is planned to accommodate 250,000 volumes. The present Department of Research in Pure Chemistry will be expanded and facilities for pure research in other branches of science will be provided. Much more elaborate chemical engineering laboratories are to be available in the new building, and also the fellowships in each specific field of industrial research are to be grouped in suites of rooms so that they can best make use of general apparatus adapted to their needs. Certain rooms will be equipped for specialized phases of experimental technic, such as spectroscopy, electrochemistry, low-temperature studies, radiations, high-pressure experimentation, etc. Other special features to be included are a large lecture hall, a dining hall, an industrial fellowship museum, and an underground garage. For the past five years members of the Institute's executive staff have been visiting important laboratories in America and Europe to obtain information on new features in design and equipment.

Radio Silenced Because of Programs: According to a dispatch from Washington, dated June 16, in the *Chicago Daily News,* "the extreme radio penalty of perpetual silence" has been meted out to station KFKB at Milford, Kan., because of "medical programs" it has broadcast on regular schedule, evidently construed to be inimical to the public health. The *News* says: "Without assigning its reason, the federal radio commission has denied the station continued operation after next Friday. . . . The . . . action . . . brings to an end the broadcasts of Dr. John R. Brinkley of the modest little Kansas town, who has been doing a thriving business in rejuvenation operations by the transplanting of glands. Dr. Brinkley has a hospital at Milford, a town of 300 population, and also an interest in the station. It was on the complaint of the American Medical Association and other organized interests that the station was haled before the commission. Charges that Dr. Brinkley conducted a 'medical question box' over the station several times each day and prescribed his own medicines by number to listeners who wrote in were made and admitted. These medicines were obtainable only at drug stores which were members of the Brinkley Pharmaceutical Association located in four middle western states." A later dispatch from Washington states that Justice McReynolds of the Supreme court refused a petition from attorneys for Dr. Brinkley to issue an order which would prevent the Kansas board of medical registration and examination from acting on a complaint to bar Brinkley from practice.

Eskimo Dentist Dead: According to a dispatch from Ottawa, Ontario, in the *Chicago Tribune,* "Siberian Mike," Eskimo dentist, died recently in the Perry River region. In 1922, according to the dispatch, the Hudson Bay Company sent a dentist to Herschel Island; Mike was employed as a dental mechanic, and when the dentist left, the Eskimo carried on an "intelligent" practice in the arctic.

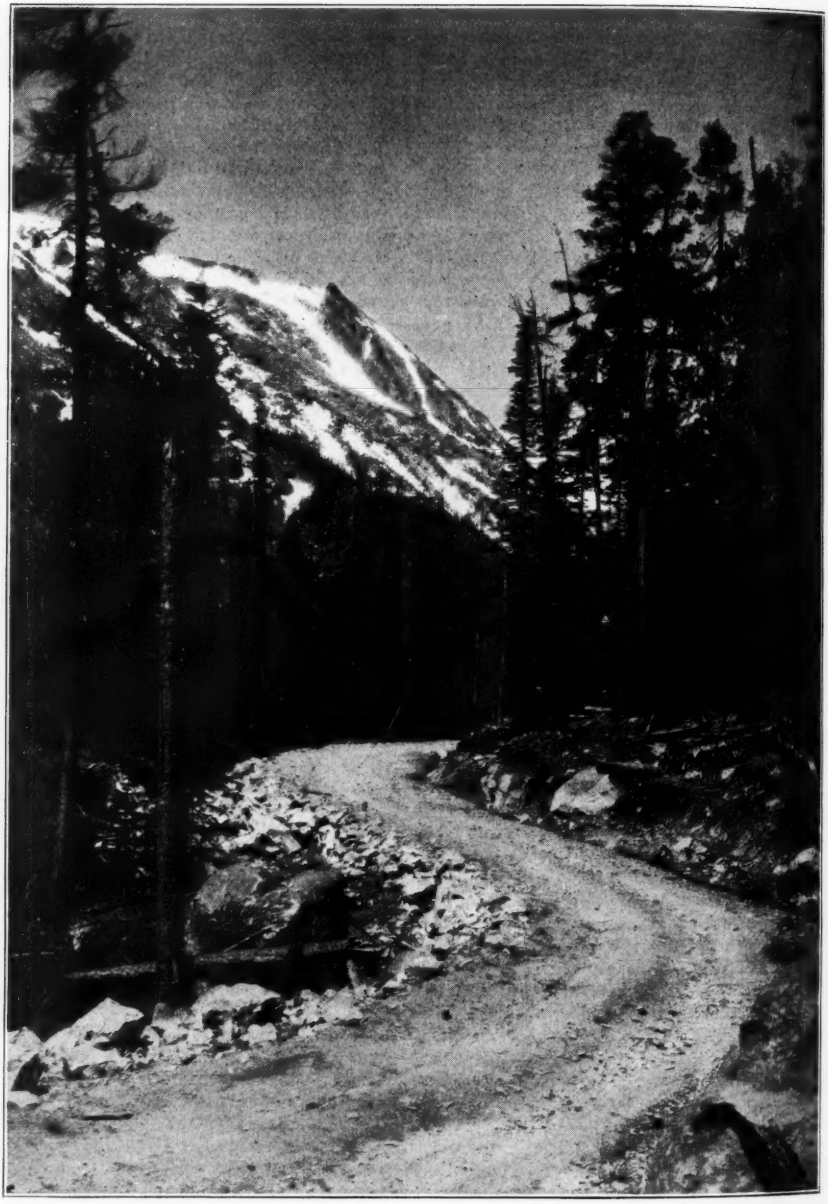
Deaths

Bartlett, Dares E., Holyoke, Mass.; died, March 27.

Brown, Daniel P., Chicago, Ill.: Northwestern University Dental School, 1923; died recently, presumably of heart failure, after a game of handball with his son. Dr. Brown was 37 years old.

Van Osdol, Charles Lee, Aurora, Ind.; Miami Medical College, Cincinnati, Ohio, died, March 4, in Tiffin, Ohio; aged 75.

Watanabe, Keitoku, Los Angeles, Calif.; Thomas W. Evans Museum and Dental Institute School of Dentistry, University of Pennsylvania, 1915; died, June 2.



Fall River Road, Colorado

ANNOUNCEMENTS*

CALENDAR OF MEETINGS

American Dental Association, Denver, Colo., July 21-25.

American Academy of Periodontology, Colorado Springs, Colo., July 17-19.

American Board of Orthodontia, Denver, Colo., July 26.

American College of Dentists, Denver, Colo., July 20.

American Dental Assistants Association, Denver, Colo., July 21-25.

American Dental Hygienists Association, Denver, Colo., July 21-25.

American Full Denture Society, Denver, Colo., July 18-19.

American Society of Oral Surgeons and Exodontists, Evergreen, Colo., July 18-19.

Association of American Women Dentists, Denver, Colo., July 21.

Australian Dental Association, Brisbane, July 7-12.

International Dental Congress, Paris, France, Aug. 3-8, 1931.

International Dental Federation, Brussels, Belgium, August 3-8.

International Orthodontic Congress, London, England, July 20-24.

National Association of Dental Examiners, Denver, Colo., July 21-22.

STATE SOCIETIES

District of Columbia, at George Washington University, Washington, D. C., second and fourth Tuesdays in each month from October to June, inclusive.

July

Wisconsin, at Milwaukee (8-10).

September

Maryland, at Ocean City (8-9).

MEETINGS OF STATE BOARDS OF DENTAL EXAMINERS

Arizona, at Phoenix, July 14. W. M. Johnson, Secretary, 1105 Luhrs Tower Building, Phoenix.

Florida, at Jacksonville, June 30-July 2. R. P. Taylor, Secretary, 414 St. James Bldg., Jacksonville.

Maine, at Augusta, June 30-July 2. Alton H. Swett, Secretary, 192 State St., Portland.

Montana, at Helena, July 14-18. T. P. Regan, Secretary, Helena.

New Mexico, at Albuquerque, July 16-18. J. J. Clarke, Secretary, Artesia.

North Dakota, at Fargo, July 8-11. Gilbert Moskau, Secretary, Grand Forks.

Vermont, at Montpelier, July 1-2. David Manson, Secretary, Burlington.

ASSOCIATION OF AMERICAN WOMEN DENTISTS

The ninth annual meeting of the Association of American Women Dentists will be held in the Olin Hotel, Denver, Colo., July 21.

MILDRED W. DICKERSON, *President*,
1624 I St., N.W., Washington, D. C.
WILHELMINA YERETSKY, *Sec'y-Treas.*,
26 Sheldon Ave., S.E., Grand Rapids, Mich.

EIGHTH INTERNATIONAL DENTAL CONGRESS

The Eighth International Dental Congress will convene in Paris, France, Aug. 3-8, 1931.

MARYLAND STATE DENTAL ASSOCIATION

The sixth semi-annual meeting of the Maryland State Dental Association will be held, September 8-9, at Ocean City. Members of the American Dental Association are invited to attend.

NORVAL H. MCDONALD, *Secretary*,
614 Medical Arts Bldg.,
Baltimore.

*Announcements must be received by the fifth day of the month in order to be published in the forthcoming issue of THE JOURNAL.

SOME RECENT BOOKS*

Available for Circulation from the

LIBRARY BUREAU

of the

AMERICAN DENTAL ASSOCIATION

58 E. Washington St., Chicago, Ill.

American Pharmaceutical Assn.	Pharmaceutical recipe book. Baltimore, Md., American Pharmaceutical Assn., 1929.
Anthony, L. P.	Dental terminology. Chicago, American Dental Assn., 1930.
Appleton, J. L. T., Jr.	Bacterial infection with special reference to dental practice. Philadelphia, Lea & Febiger, 1925.
Appleton, J. L. T., Jr., & Bryant, C. K.	Laboratory guide in bacteriology. Philadelphia, Lea & Febiger, 1928.
Barail, L. C.	High-frequency in dentistry. Paris, France, La Verrerie Scientifique, 1927. (Pamphlet.)
Bartels, H. A.	Outline of bacteriology. New York, W. A. Broder, 1929.
Berger, Adolph	Principles and technique of oral surgery. Brooklyn, Dental Items of Interest Pub. Co., 1927.
Berger, Adolph	Principles and technique of the removal of teeth. Brooklyn, Dental Items of Interest Pub. Co., 1929.
Bilpodiwala, M. C.	Care of the teeth, or layman's handbook of dentistry. Bombay, India, Author, 1927.
Blunt, Katharine, & Cowan, Ruth	Ultraviolet light and vitamin D in nutrition. Chicago, University of Chicago Press, 1930.
Bödecker, C. F.	Elementary histology for dental hygienists. New York, W. A. Broder, 1929.
Box, H. K.	Necrotic gingivitis. Toronto, University of Toronto Press, 1930. (Pamphlet)
Box, H. K.	Treatment of the periodontal pocket. Toronto, University of Toronto Press, 1928.
Bregstein, S. J.	Business conduct of an ethical practice. Brooklyn, Dental Items of Interest Pub. Co., 1929.
Broderick, F. W.	Dental medicine. St. Louis, Mosby, 1928.
Broderick, R. A.	Dental bacteriology. Outlines of dental science. Vol. 2. Edinburgh, Livingstone, 1926.
Brothers, E. D.	Dental jurisprudence. St. Louis, Mosby, 1928.
Brown, A. J.	Dental metallurgy. Outlines of dental science. Vol. 11. New York, Wood, 1928.
Brown, W. L.	Endocrines in general medicine. St. Louis, Mosby, 1927.
Buckley, J. P.	Modern dental materia medica, pharmacology and therapeutics. Philadelphia, Blakiston, 1926.
Bulleid, Arthur	Textbook of bacteriology for dental students. St. Louis, Mosby, 1927.
Bunting, R. W.	A text-book of oral pathology for students and practitioners of dentistry. Philadelphia, Lea & Febiger, 1929.
Burchard, H. H., & Inglis, O. E.	Textbook of dental pathology and therapeutics for students and practitioners. Philadelphia, Lea & Febiger, 1926.

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Burkhart, H. J.	Care of the mouth and teeth. (National Health Series.) New York, Funk & Wagnalls, 1928.
Buxton, J. L. D.	Dental pathology. Outlines of dental science. Vol. 7. New York, Wood, 1927.
Buxton, J. L. D.	Dental surgery. Outlines of dental science. Vol. 8. New York, Wood, 1927.
Cahn, L. R.	Basic principles of general and oral pathology. Brooklyn, N. Y., Dental Items of Interest Pub. Co., 1929.
Campbell, J. M.	Those teeth of yours. London, Heinemann, 1929.
Cattell, Psyche	Dentition as a measure of maturity. Cambridge, Harvard University Press, 1928.
Clapp, G. W.	Life and work of James Leon Williams. New York, Dental Digest, 1925.
Clark, C. A.	Dental radiography. Outlines of dental science. Vol. 5. New York, Wood, 1926.
Colyer, Stanley	Chronic infection of the jaws: a short radiological and clinical study. New York, Macmillan, 1926.
Daukes, S. H.	Medical museum: Modern developments, organization and technical methods based on a new system of visual teaching. London, Wellcome Foundation, Ltd., n.d.
Dental Board of the United Kingdom	Four lectures on "general anaesthesia." London, Dental Board of the United Kingdom, 1926.
Dental Board of the United Kingdom	Three lectures on "dental alloys." Delivered under the auspices of the Dental Board of the United Kingdom. London, Dental Board of the United Kingdom, 1927.
Diamond, M.	Dental anatomy. A graphic presentation of tooth forms with an original technique for their reproduction. New York, Macmillan, 1929.
Endleman, Julio	Special dental pathology: a treatise for students and practitioners. St. Louis, Mosby, 1927.
Federspiel, M. N.	Harelip and cleft palate. St. Louis, Mosby, 1927.
Feldman, M. H.	Manual of exodontia. Philadelphia, Lea & Febiger, 1930.
	First International Orthodontic Congress: held at New York City, August 16-20, 1926. St. Louis, Mosby, 1927.
Fones, A. C.	Mouth hygiene; a textbook for dental hygiene. Philadelphia, Lea & Febiger, 1927.
Fones, A. C.	Preventive dentistry. Philadelphia, Lea & Febiger, 1925.
Foote, J. S.	Bone as a measure of development: When and how we acquired our teeth. Chicago, American Dental Association, 1928.
Franzen, Raymond	Public health aspects of dental decay in children. New York, American Child Health Assn., 1930.
Gies, W. J.	Dental education in the United States and Canada. New York, Carnegie Foundation, 1926.
Goepp, R. M.	Dental state board questions and answers. Philadelphia, Saunders, 1928.
Goslee, H. J.	Principles and practice of crown and bridgework. Brooklyn, Dental Items of Interest Pub. Co., 1926.
Greenfield, A. L.	Interpretation of dental radiograms. Rochester, N. Y., Ritter Dental Mfg. Co., 1926.
Gregory, W. K.	Our face from fish to man. New York, Putnam, 1929.
Guerini, Vincenzo	Life and works of Guiseppangelo Fonzi. Philadelphia, Lea & Febiger, 1925.
Gwinn, C. D.	Textbook of exodontia. Philadelphia, Lea & Febiger, 1927.
Gysi, Alfred	Special teeth for cross-bite cases. New York, Dentists' Supply Co., 1928. (Pamphlet.)

SOME RECENT BOOKS*

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58 E. Washington St., Chicago, Ill.

American Pharmaceutical Assn.	Pharmaceutical recipe book. Baltimore, Md., American Pharmaceutical Assn., 1929.
Anthony, L. P.	Dental terminology. Chicago, American Dental Assn., 1930.
Appleton, J. L. T., Jr.	Bacterial infection with special reference to dental practice. Philadelphia, Lea & Febiger, 1925.
Appleton, J. L. T., Jr., & Bryant, C. K.	Laboratory guide in bacteriology. Philadelphia, Lea & Febiger, 1928.
Barail, L. C.	High-frequency in dentistry. Paris, France, La Verrerie Scientifique, 1927. (Pamphlet.)
Bartels, H. A.	Outline of bacteriology. New York, W. A. Broder, 1929.
Berger, Adolph	Principles and technique of oral surgery. Brooklyn, Dental Items of Interest Pub. Co.; 1927.
Berger, Adolph	Principles and technique of the removal of teeth. Brooklyn, Dental Items of Interest Pub. Co., 1929.
Bilpodiwala, M. C.	Care of the teeth, or layman's handbook of dentistry. Bombay, India, Author, 1927.
Blunt, Katharine, & Cowan, Ruth	Ultraviolet light and vitamin D in nutrition. Chicago, University of Chicago Press, 1930.
Bödecker, C. F.	Elementary histology for dental hygienists. New York, W. A. Broder, 1929.
Box, H. K.	Necrotic gingivitis. Toronto, University of Toronto Press, 1930. (Pamphlet)
Box, H. K.	Treatment of the periodontal pocket. Toronto, University of Toronto Press, 1928.
Bregstein, S. J.	Business conduct of an ethical practice. Brooklyn, Dental Items of Interest Pub. Co., 1929.
Broderick, F. W.	Dental medicine. St. Louis, Mosby, 1928.
Broderick, R. A.	Dental bacteriology. Outlines of dental science. Vol. 2. Edinburgh, Livingstone, 1926.
Brothers, E. D.	Dental jurisprudence. St. Louis, Mosby, 1928.
Brown, A. J.	Dental metallurgy. Outlines of dental science. Vol. 11. New York, Wood, 1928.
Brown, W. L.	Endocrines in general medicine. St. Louis, Mosby, 1927.
Buckley, J. P.	Modern dental materia medica, pharmacology and therapeutics. Philadelphia, Blakiston, 1926.
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Gysi, Alfred	Special teeth for cross-bite cases. New York, Dentists' Supply Co., 1928. (Pamphlet.)

Hackh, I. W. D.	Chemical reactions and their equations. Philadelphia, Blakiston, 1928.
Haden, R. L.	Dental infection and systemic disease. Philadelphia, Lea & Febiger, 1928.
Hanau, R. L.	Dental engineering. Buffalo, N. Y., Author, 1926.
Hanau, R. L.	Hanau intraoral method vs. Gysi extraoral method. Buffalo, N. Y., Author, 1927.
Hartman, L. L.	Teeth and the mouth. New York, Appleton, 1927.
Head, Joseph	Everyday mouth hygiene. Philadelphia, Saunders, 1925.
Headridge, David, & Gibson, S. K.	Dental anatomy, human and comparative. Outlines of dental science. Vol. 6. New York, Wood, 1928.
Hedstrom, Gustav	Gangrene of dental pulp and its treatment. Stockholm, Sweden, Isaac Marcus, 1927.
Herbst, Emil, & Apffelstaedt, Max	Atlas and grundriss der missbildungen der kiefer and zähne. München, J. F. Lehmanns, 1928.
Hertzler, E.	Technic of local anesthesia. St. Louis, Mosby, 1925.
Hess, Walter, & Zurcher, Ernst	Anatomy of the root-canals of the teeth. New York, Wood, 1925.
Hogeboom, F. E.	Practical pedodontia or juvenile operative dentistry and public health dentistry. St. Louis, Mosby, 1927.
Hyatt, T. P.	Hygiene of mouth and teeth. Brooklyn, N. Y., Brooklyn Dental Pub. Co., 1929.
Jamieson, J. D. H.	Operative dentistry. Outlines of dental science. Vol. 9. New York, Wood, 1927.
Jerman, E. C.	Modern x-ray technic. St. Paul, Bruce Pub. Co., 1928.
Jordan, M. Evangeline	Operative dentistry for children. Brooklyn, Dental Items of Interest Pub. Co., 1927.
Kanner, Leo	Folklore of the teeth. New York, Macmillan, 1928.
Kells, C. E.	Dentists' own book, including a complete bookkeeping and recording system. St. Louis, Mosby, 1925.
Kells, C. E.	Three score and nine. New Orleans, The Author, 1926.
Kennedy, Edward	Partial denture construction. Brooklyn, N. Y., Dental Items of Interest Pub. Co., 1928.
Kent, E. N.	Business side of dentistry. St. Louis, Mosby, 1929.
LeGro, A. L.	Ceramics in dentistry. Brooklyn, Dental Items of Interest Pub. Co., 1926.
Leriche, R., & Policard, A.	Normal and pathological physiology of bone. St. Louis, Mosby, 1928.
Livingston, Alexander	Dental histology. Outlines of dental science. Vol. 10. New York, Wood, 1928.
Logan, J. D.	Dental prosthetics. Outlines of dental science. Vol. 4. Edinburgh, Livingstone, 1926.
Marriott, W. M.	Infant nutrition: a textbook of infant feeding for students and practitioners of medicine. St. Louis, Mosby, 1930.
Marsden, P. H.	Dental materia medica. Outlines of dental science. Vol. 3. Edinburgh, Livingstone, 1926.
McCollum, E. V., & Simmonds, Nina	Food, nutrition and health. Baltimore, Authors, 1928.
McCoy, J. D.	Applied orthodontia. Philadelphia, Lea & Febiger, 1927.
McGaw, Emma J.	Dental assistant. St. Louis, Mosby, 1926.
Marshall, J. A.	Diseases of the teeth; their diagnosis and treatment. Philadelphia, Lea & Febiger, 1926.
Mead, S. V.	Diseases of the mouth. St. Louis, Mosby, 1928.
Mellanby, May	Diet and the teeth: an experimental study. Part I. Dental structure in dogs. London, His Majesty's Stationery Office, 1929.

Merritt, A. H.	Periodontal diseases: diagnosis and treatment. New York, Macmillan, 1930.
Moorehead, F. B., & Dewey, Kaethe W.	Pathology of the mouth. Philadelphia, Saunders, 1925.
Nevin, Mendell, & Puterbaugh, P. G.	Conduction, infiltration and general anesthesia in dentistry. Brooklyn, Dental Items of Interest Pub. Co., 1927.
	New and nonofficial remedies, 1929. Chicago, American Medical Association, 1929.
Orban, Balint	Dental histology and embryology. Philadelphia, Blakiston, 1929.
Osgood, H. A.	Teeth and jaws roentgenologically considered. Annals of roentgenology, volume 5. New York, Hoeber, 1929.
Ottolengui, Rodrique	Table talks on dentistry. Brooklyn, Dental Items Interest Pub. Co., 1928.
Owre, Alfred	Prunes or pancakes. Minneapolis, University of Minnesota Press, 1926.
Posner, J. J.	Minor oral surgery simplified. Philadelphia, Patterson & White, 1928.
Prinz, Hermann	Dental formulary. Philadelphia, Lea & Febiger, 1930.
Prinz, Hermann	Dental materia medica and therapeutics. St. Louis, Mosby, 1926.
Prinz, Hermann	Diseases of soft structures of teeth. Philadelphia, Lea & Febiger, 1928.
Raper, H. R.	Clinical preventive dentistry. Rochester, N. Y., Ritter Dental Mfg. Co., 1926.
Rapp, F. W.	Elements of anatomical articulation or the mathematics of dental prosthetics. London, Bale, 1930.
Reidy, M. J.	This tooth proposition. Des Moines, Iowa, Author, 1927.
	Ritter practice building suggestions. Rochester, N. Y., Ritter Dental Mfg. Co., 1926.
Roberts, Lydia J.	Nutrition work with children. Chicago, University of Chicago Press, 1927.
Rose, Mary Swartz	Foundations of nutrition. New York, Macmillan, 1927.
Schroff, Joseph	Fundamentals of pathology. New York, W. A. Broder, 1929.
Sears, V. H.	Full denture procedure. New York, Macmillan, 1929.
Shaw, D. M.	Dental prosthetic mechanics. London, Arnold, 1927.
Sicher, Harry, & Tandler, Julius	Anatomie für Zahnärzte. Vienna, Julius Springer, 1928.
Silverman, S. L.	Principles and practice of oral surgery. Philadelphia, Blakiston, 1926.
Simon, P. W.	Fundamental principles of a systematic diagnosis of dental anomalies. Boston, Stratford, 1926.
Simon, W., & Base, Daniel	Manual of chemistry. Philadelphia, Lea & Febiger, 1927.
Simpson, C. O.	Technic of oral radiography. St. Louis, Mosby, 1928.
Smith, G. F. R.	Dental anesthesia. Outlines of dental science. Vol. 1. Edinburgh, Livingstone, 1926.
Sorrin, Sidney, & Miller, S. C.	Practice of periodontia. New York, Macmillan,1928.
Steadman, F. St. J.	Pyorrhea alveolaris. St. Louis, Mosby, 1927.
Stieglitz, Julius	Chemistry in medicine. New York, Chemical Foundation, 1928.
Stillson, W. C.	Dental anatomy: classroom and laboratory quiz compend with supplementary notes. Philadelphia, Saunders, 1929.
Stoloff, C. I.	Your teeth. New York, Dutton, 1929.
Tanguy, T. V.	Science and practice of actinotherapy. St. Louis, Mosby, 1928.
Turner, C. R., & Anthony, L. P.	American textbook of prosthetic dentistry. Philadelphia, Lea & Febiger, 1928.

Tyree, C.	Dental health in the prevention of disease. London, Kentucky, Author, 1927.
Wallace, J. S.	Physiology of oral hygiene and recent research. London, Bailliere, Tindall & Cox, 1929.
Wallace, J. S.	Teeth and health. London, Faber & Gwyer, 1926.
Wallace, J. S.	Variations in the form of the jaws, with special reference to their etiology and their relation to the occlusion of the dental arches. New York, Wood, 1926.
Wang, C. Y.	Handbook of pathology. New York, Wood, 1925.
Ward, L. (Ed.)	American textbook of operative dentistry. Philadelphia, Lea & Febiger, 1926.
Weinberger, B. W.	Orthodontics: an historical review of its origin and evolution. 2 vols. St. Louis, Mosby, 1926.
Wells, F. M.	Sound teeth in a sound body. Montreal, Author, 1926.
Widdowson, T. W.	Notes on dental anatomy and physiology and dental histology. London, John Bale, 1928.
Winter, G. B.	Principles of exodontia, as applied to the impacted mandibular third molar. St. Louis, American Medical Book Co., 1926.
Winter, Leo	Textbook of exodontia. St. Louis, Mosby, 1927.
Woodbury, C. E.	Making and filling of cavities in the proximal surface of the front teeth with gold foil. Omaha, Nebr., Author, 1929.
Zoethout, W. D.	Textbook of physiology. St. Louis, Mosby, 1928.

A list of the Package Libraries available for circulation from the Library Bureau of the American Dental Association was published in the June, 1930 issue of THE JOURNAL.

Independence Pass Highway above Aspen

AMERICAN DENTAL ASSOCIATION

Denver, Colorado. July 21-25, 1930.

HOTEL RESERVATIONS

In securing hotel reservations for the 1930 Session, consult the hotel rate-sheet and fill out the blank application below. Mail immediately to the hotel you wish to patronize. The hotel will then advise you of the reservation that has been made for you.

Kindly indicate second and third choices.

Please remember that reservation constitutes a contract with the hotel to provide you with the accommodations you desire. If you find it impossible to carry out your part of the contract, please write or wire the hotel, releasing it.

MAIL THIS APPLICATION DIRECT TO THE HOTEL

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AMERICAN DENTAL ASSOCIATION, DENVER, COLO., JULY 21-25, 1930 .....

.....Hotel. 1930

Please reserve sleeping room accommodations noted below:

.....Room(s) with bath for.....people. Rate desired $.....
(per day)

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Second choice: .....

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ROOMS TO BE OCCUPIED BY: ADDRESS IN FULL

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Please confirm this reservation to applicant. I further agree to notify the hotel at once in the event I am unable to use this reservation.

IMPORTANT TO HOTEL MANAGER: In the event you cannot accept this reservation, please forward this application at once to Dr. I. R. Bertram, Chairman Halls and Hotels, 1222 Republic Bldg., Denver, Colorado, who will attend to its assignment.

HOTEL	Rooms	Single with Bath	Double with Bath	Single without Bath	Double without Bath
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AMBASSADOR 1728 California	92	2.00	2.50	1.50	2.00
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BROWN PALACE 17th & Tremont	300	5.00 up	8.00 up		
COLBURN 10th & Grant	100	3.50-5.00	5.00-8.00		
COLORADO 17th & Tremont	100	2.50-3.00	4.00-5.00	1.50-2.00	2.50-3.00
COSMOPOLITAN 18th & Broadway	460	3.00-5.00	5.00-10.00	1.50-2.00	2.50-4.00
CREST 1924 Welton	114	2.00 up	3.00 up	1.50	2.00
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HOTEL	Rooms	Single with Bath	Double with Bath	Single without Bath	Double without Bath
MIDLAND 1106 17th	70	3.00	4.00	1.50-3.00	2.00-3.00
MILLS 1321 Logan	60	2.50	4.00	1.50	2.00
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OLIN 1420 Logan	125	2.50-4.00	6.00		
O'NEILL 1407 Stout	60	2.00	3.50	1.50	2.50
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SEARS 1755 California	94	2.50-3.00	3.00-8.00	2.00	2.50-3.00
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STANDISH 1530 California	125	2.50	3.50	1.50	2.50
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WEST 1337 California	112	2.50	3.50	1.25-1.50	2.00-2.50
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